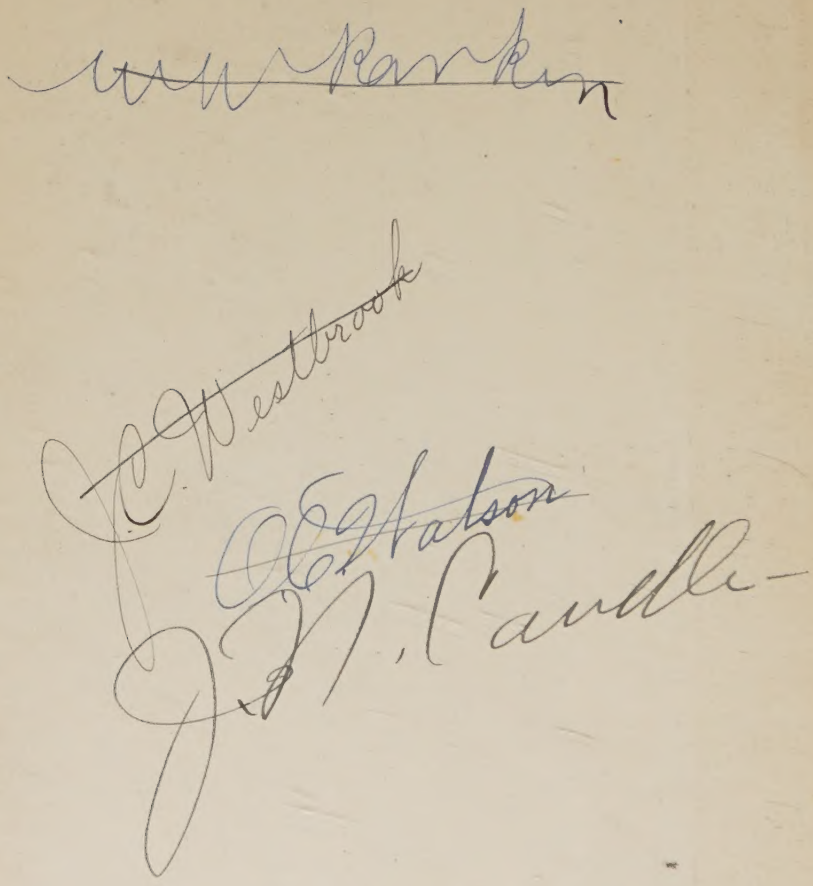

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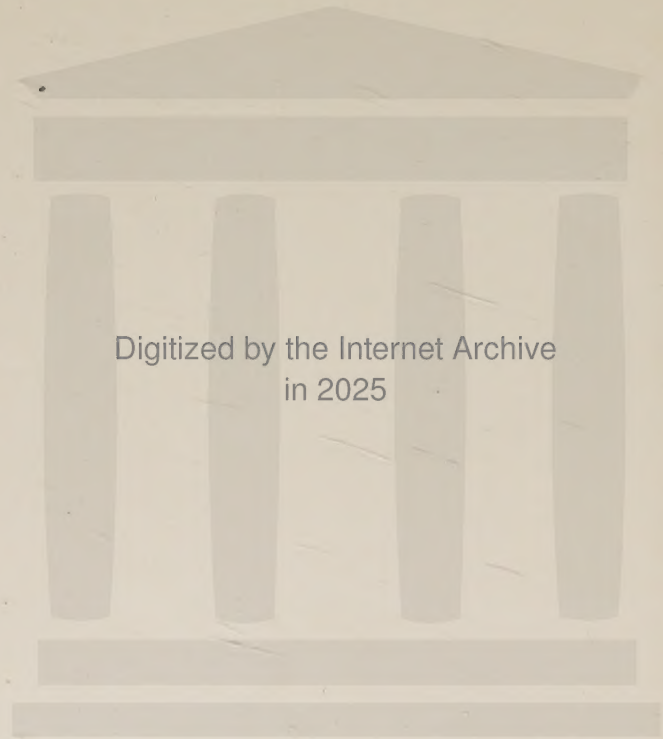
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PREVENTIVE DENTISTRY

FOR DENTAL STUDENTS

BY

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ILLUSTRATED WITH 103 ENGRAVINGS

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PREFACE.

PREVENTIVE Dentistry covers many of the biological laws which nature intended should govern the growth and development of a perfect human organism. It has been said that "the mouth is the show window in which the body displays its physical wares," and we have come to the realization that dense and well-formed teeth with perfectly developed jaws are indices of a sound and well-formed body. A perusal of the findings of the most advanced thinkers in Preventive Medicine who are endeavoring to grow children free from physical defects and with a high degree of natural immunity to disease, shows a definite tendency to get in harmony with natural laws and not to substitute artificial measures during the period of development. It will take a long time for the medical profession to agree finally that there can be no real substitute for breast-feeding of infants, and the more that the subject of foods is understood the less use there will be for refined and processed substitutes.

It would be impossible in the first book on Preventive Dentistry to cover all the phases which have a definite influence in securing sound teeth and healthy mouths. Only some of the main subjects are touched upon. These will prove helpful to the student and may inspire him to broader reading on the subject. In the author's opinion a chair of Preventive Dentistry should be established eventually in each of our dental schools. A vivid picture of normality,

its production and maintenance, should be presented to the student mind, and only through a continuous course, carrying a continuity of thought, can this subject be made sufficiently impressive.

It would be unfair, in presenting this publication, not to acknowledge herein the great assistance rendered me by Enid Cortright Newman. Through her unselfishness in giving so much of her time and her intelligent compilation of my previous writings and research study, this book is made possible.

A. C. F.

Bridgeport, Conn., 1925.

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PREVENTIVE DENTISTRY.

CHAPTER I.

FOREWORD.

The five essentials for normal cell life in the human organism are oxygen, water, proper food, correct temperature and the elimination of waste products. The study of general hygiene as well as mouth hygiene is based directly or indirectly upon these essentials. The health laws which govern the individual cell govern the organism as a whole, and the same natural laws apply to the health of communities.

If body cells are robbed of one of these health factors the tissue becomes diseased, and only after the restoration of the missing essential does the tissue tend to return to normal.

Dental surgeons have but little power to cure—that is the prerogative of those intelligent units, the cells. When it is possible for a dentist to remove the exciting cause of the disease the cells will of themselves tend to restore normal balance and function.

Thus it is that any procedure which has for its aim the prevention or removal of the *cause*, rather than the *effect*, of dental disease is termed preventive dentistry.

True prevention of dental disease is in its larger conception a matter of education rather than operative procedure.

It embraces those principles of diet, and all other phases of hygiene, which produce and maintain healthy mouths. Every dentist should realize that education for true prevention constitutes the most important part of his service to humanity. The object of preventive dentistry courses is, therefore, to present to the student the operations of dentistry from the standpoint of prevention of future disease by scientific effort on his part, and to create a realization of the possibilities of true prevention through private or public educational measures. *The prevention of dental diseases is dependent upon the integrity of two tissues, the gingiva and the enamel.*

There is no better means of realizing the aim of true prevention than a clear mental picture of these dental tissues in a state of health. The following brief résumé of normal histology is given to facilitate this conception.

NORMAL HISTOLOGY OF THE DENTAL TISSUES.

The Gum Tissue.—The gum is chiefly a binding and defensive tissue. Its function is to aid, as an unyielding mat, in tightly binding together the teeth and the bone structure and to act as an armor, or protective covering, to the underlying tissues. For purposes of study the gum is divided into: (1) The *body*, (2) the *gingiva* and (3) the *mucous membrane.*

The *body of the gum* is composed of coarse white fibers that are interlaced with each other and are tightly interlocked with the fibers of the periosteum which covers the alveolar process. The firm attachment to the periosteum renders the healthy gum quite immobile. The gum tissue covers all the alveolar structure, running to the point where the mucous membrane is reflected back labially and buccally

to line the lips and cheeks. On the upper jaw it covers all the hard palate, extending back to the soft palate, and on the lower jaw lingually to the floor of the mouth. Passing between the fibers are the larger bloodvessels which come from the walls of the alveolar process, and from the pericementum through the space at the border of the alveolus.

The *gingiva* is that portion of the gum which covers the crest of the alveolar process. It forms the soft tissue around the neck and fills the interproximal space (Fig. 2). In structure it is a continuation of the body of the gum, but the fibers are finer and more densely woven. Quite a large proportion of the tissue is made up of fibers from the gingival portion of the pericementum. The free or marginal gingiva is the extension of the soft tissue that covers the neck of the tooth and lies in contact with the enamel. The upper border of the marginal gingiva is called the *crest,* which flattens down to a thin edge. The gingival tissue is not attached to the enamel, but at the bottom of the subgingival space it is attached to the cementum by the pericemental fibers (Fig. 1). This point in the subgingival space is the most vulnerable area through which bacteria can gain access to the underlying tissues. Therefore, from the standpoint of prevention of disease of the investing tissues, *this attachment must be maintained.* In a perfectly normal healthy mouth the interproximal spaces should be completely filled by the septal gingivæ, which slide the food off to the tongue and muscles of the lips and cheeks when squeezed down the sluiceways from the planes of the teeth during mastication. By completely filling the space this tissue prevents the lodgment of food therein, and thoroughly protects the enamel surfaces. Dentists are apt to treat the septal gingiva with too little consideration, frequently forcing it out of the way, or even destroying it, when it

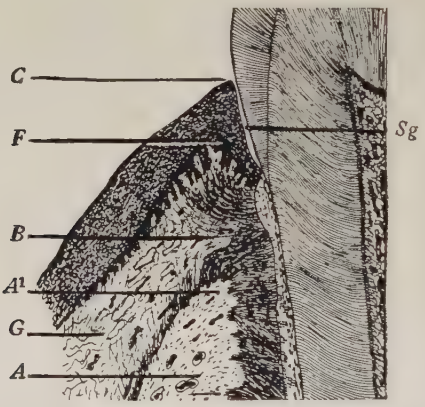


FIG. 1.—Bucco-lingual section through tooth and investing tissues. *A*, alveolar process; A^1 crest of alveolar process; *G*, gum; *B*, body of gingiva; *C*, crest of septal gingiva; *F*, free or marginal gingiva; *Sg*, subgingival space. (Black.)

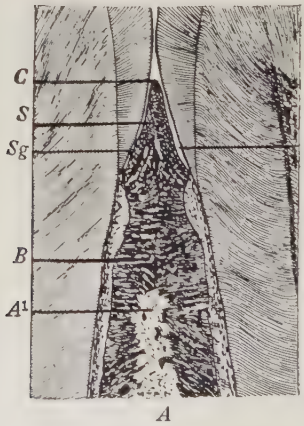


FIG. 2.—Mesio-distal section through first and second bicuspids and septal tissue. *A*, alveolar process; A^1, crest of alveolar process; *B*, body of gingiva; *S*, septal gingiva; *C*, crest of septal gingiva just below contact point; *Sg*, subgingival space. *Note the attachment of the gingiva forming bottom of this space, and protecting the underlying tissues.* (Black.)

interferes with their operations. This tissue should receive great consideration because of its protective function.

The *mucous membrane* covers all of the soft tissues of the mouth, and secretes a fluid known as mucus, which acts as a lubricant and a protection to its surface. In its corium, or basement layer, are projected papillæ of densely woven connective tissue, and running up into these papillæ are small arterioles which break up into networks of capillaries.

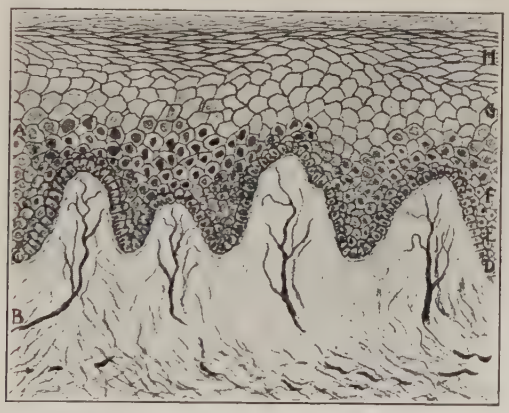


FIG. 3.—Diagrammatic illustration of section of gum tissue showing: *A*, epithelium, *B*, corium and the papillæ; *C*, basement membrane; *D*, columna cells; *E*, prickle cells; *F*, six-sided cells; *G*, squamous cells; *H*, flattened dead cells. (Talbot.)

These capillaries are quite close to the surface, but are covered by layers of transparent epithelial cells. Interwoven in this area of the basement membrane are elastic fibers which quickly draw the tissue together if it is cut or wounded, so that the opening may immediately heal. The epithelial or corneous layer is of great importance.

In the lower portion of the epithelial layer the cells have nuclei, and after forming move upward toward the surface.

In this transit the cytoplasm, or content of the cell body, gradually changes, the nucleus disappears and a tough and horny-like substance is formed, known as *keratin.* The cells of the skin possess this property to a marked degree, as exemplified by corns on the feet, or the horny hands of the day laborer. The stratified cells having this property are found only on those portions of the mucous membrane which cover the gum tissue of the alveolar process and the roof of the mouth. They disappear where the membrane folds back on the lips or cheeks, which accounts for the sur-

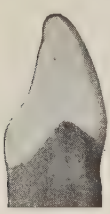


Fig. 4.

Fig. 5.

Fig. 6.

Figs. 4, 5 and 6.—Showing the curvature of the gingival line on the proximal surfaces. Compare the line on the cuspid (which is similar to centrals and laterals) to that of the bicuspid and molar. (Black.)

faces being easily wounded by a misfitting plate. The cells lining the subgingival space are larger in size, more easily joined, retain their nuclei and are not covered with a squamous epithelium. It is this area which so readily permits of the ingress of bacteria when conditions are favorable.

Every student should know the general line of the gingivæ around the different teeth. This line is convex on the approximal surfaces of the incisors and cuspids, and nearly straight around the bicuspids and molars. The depth of the subgingival space is greater on the approximal

surfaces than on the labial, buccal, or lingual surfaces, in spite of the fact that the gingival line of attachment is convex on the approximal area. It is this extension of the gingivæ to the approximal contact points that gives the gums their festooned appearance (Figs. 4, 5 and 6).

Normal gum tissue is light pink, and of a uniform color in all parts of the mouth.

The Pericementum.—This may well be considered the most important of the dental tissues. The normal function of a tooth depends upon the health and vitality of the pericementum. Should this tissue become diseased and a portion of it destroyed, especially the gingival portion, it is but a question of time when the tooth will be lost. The pericementum is composed of white fibers made by cells known as fibroblasts, and for the purpose of study is divided into three parts: (1) The *gingival portion,* or that area which lies occlusally to or above the border of the alveolar process; (2) the *alveolar portion,* or that section which is in contact with the alveolus and the side of the root; (3) the *apical portion,* or that section surrounding the apex of the root of the tooth. One end of all of these fibers is attached to the root of the tooth in a bone-like tissue known as the cementum. In the cementum are cells called cementoblasts, whose function is to build a hard or calcified tissue around the ends of the fibers, and thus securely fasten them to the root. The opposite ends of the fibers in the alveolar and apical portions are built into the walls of the alveolus by cells known as osteoblasts. There are also found within this fibrous tissue cells known as osteoclasts (Figs. 7 and 8).

When a tooth is submitted to undue stress or pressure for a lengthy period, at any angle to the walls of the socket, the osteoclasts liberate the ends of the fibers of the pericementum where the greatest stress comes by dissolving out

a portion of the alveolus and the cementum. When the stress is relieved the cementoblasts and the osteoblasts

FIG. 7.—Fibers of the pericementum passing from the cementum, *a*, to the alveolar wall, *b*. (Black.)

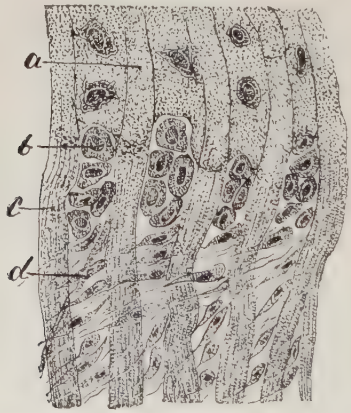


FIG. 8.—From section including a portion of the alveolar wall and fibers of the pericementum. *a*, bone; *b*, osteoclasts; *c*, principle fibers of the pericementum; *d*, interfibrous tissue. (Black.)

rebuild their hard tissue around the ends of the fibers, restoring them again to normal function. This process is

of special interest to the orthodontist, and explains why the correction of malocclusion should not be hurried, but ample time be allowed for the cells to perform this work while the teeth are being moved into new positions.

The Arrangement of the Fibers.—In the apical region the fibers radiate in all directions, and tend to center the tooth between the walls of the alveolus. In the lower two-thirds of the alveolar portion they are large, and slant from the root occlusally to the walls of the socket. These sustain most of the pressure during mastication, and literally hold the tooth in a swing. In the upper third of the alveolar portion the fibers pass directly across to the alveolus, or at right angles with the cementum, and help to prevent the rotation of the tooth. The gingival portion has the greatest interest for the student, for here the fibers are found close to the surface. Below the neck of the tooth, and at the border of the alveolar process, strong bands of fibers spring from the cementum and pass directly across to the periosteum which covers the alveolar process, interlacing and blending with the fibers of this membrane. These fibers are known collectively as the *dental ligament*, and it is this strap-like band which holds the tooth securely in its socket. If the dental ligament is destroyed the tooth loses its greatest and most important retainer. Directly above the dental ligament are sets of fibers which pass out horizontally into the gum tissue. On the approximal surfaces they pass through the gum tissue to the adjoining tooth, and the ends are fastened into the cementum of the neighboring tooth. They form a basket-like network in appearance, and aid greatly in the support of the gums. Lastly, at the highest point occlusally of the cementum a number of fibers pass into the gingiva, helping to support the border of the gum and hold it close to the neck of the tooth. It may readily

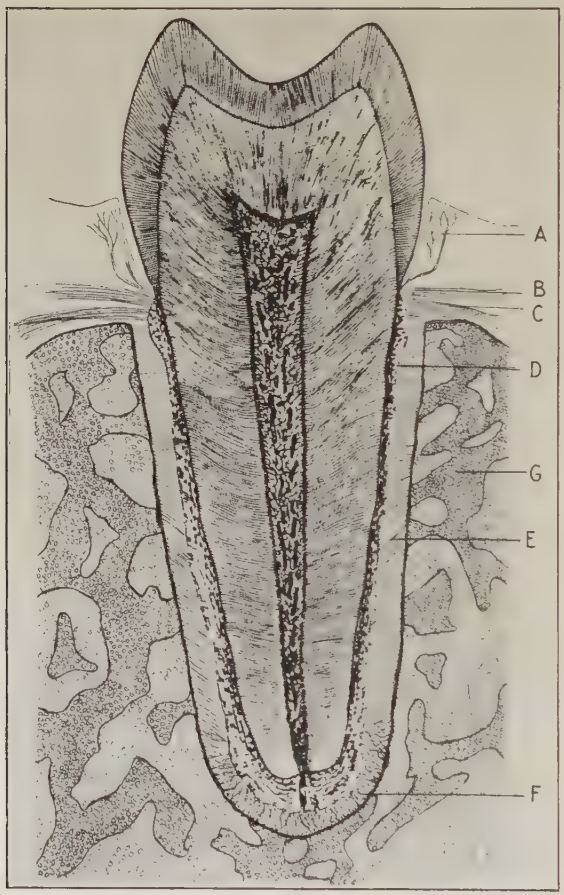


FIG. 9.—Diagram of bucco-lingual section through a bicuspid tooth and investing tissue, showing the arrangement of the principal fibers of the pericementum. In the gingival portion: *A*, the free gingivæ group of fibers; *B*, the trans-septal group of fibers; *C*, the alveolar crest group of fibers or dental ligament. In the alveolar portion: *D*, the horizontal group of fibers; *E*, the oblique group of fibers; *F*, the apical group of fibers; *G*, bone of alveolar process.

be seen that if the two sets of fibers in the gingival portion are kept in a normal state there is but little likelihood of the tooth being lost. There are two strong defenses that must be broken down before the dental ligament is reached, and when the gingival border is in a state of health it protects the vital tissues beneath (Fig. 9). When a tooth in the arch is lost this binding-together scheme of the second set of fibers is broken, and the pull and strain on the adjoining teeth renders their support unequal.

If the alveolus is absorbed on the approximal surface of a incisor, forming a pocket, and the gingival portion of the pericementum is destroyed, the strong attachments of the fibers on the opposite side of the tooth will draw the tooth in that direction, and a space will soon be noticed between the incisors. If, at the neck of the tooth a ligature, clamp, or band is forced down so as to cut or wound the fibers it may start a destructive process that will eventually cause the loss of the tooth.

The pericementum has four important functions: (1) To supply sense of touch for the tooth; (2) to hold the tooth in its socket, and withstand the force of mastication; (3) to bind the teeth together; (4) to give stability to the gum tissue and support to the gingiva. In youth, when a tooth first erupts, this tissue is thick, very vascular and highly resistant to infection. After the root is completely formed the osteoblasts thicken the walls of the alveolus, and the cementoblasts form layers, or lamallæ, on the cementum, which is gradually thickened. The slow encroachment on the pericementum continues throughout life until, in old age, the walls of the alveolus and cementum come nearly in contact.

THE ALVEOLAR PROCESS.

The alveolar process is the bony supporting structure of the teeth, and is built up coincident to the eruption of the teeth. It is, therefore, a product of function, and its structure is constantly rearranged throughout life to accommodate changing forces. In structure it resembles bone of the cancellous type arranged in varying degrees of thickness to provide perfect support for each tooth, with the least

FIG. 10.—Transverse section through the roots of two bicuspids and first molar, showing compact alveolar structure of buccal and lingual plates and cancellous interproximal structure. The alveolar process is highly vascular. (Noyes.)

possible bulk. In general, the labial and lingual plates are dense to restrict the buccal and lingual movements of the teeth, while the interdental structure is less compact, each tooth depending upon the approximating teeth for support (Fig. 10). It is a very vascular tissue, with the exception of the crest or terminal rim, which in civilized man is a thin attenuated edge. After middle-age these thin borders suffer from inadequate peripheral circulation, resulting in absorption of the terminal edge of the alveolar process, with consequent recession of the gum tissue in varying degrees.

The natural supposition would be that in a healthy mouth the alveolar process would remain intact during normal function, but clinical experience bears out the fact that this tissue is transitory and unstable in structure, and that its gradual absorption during adult life occurs with such constancy that it is regarded as a physiological process. Nevertheless, this condition could doubtless be improved if, during the period of development of the alveolar process, the function of mastication was increased. The bone cells would respond to the stimulation of forceful mastication by building thicker alveolar borders.

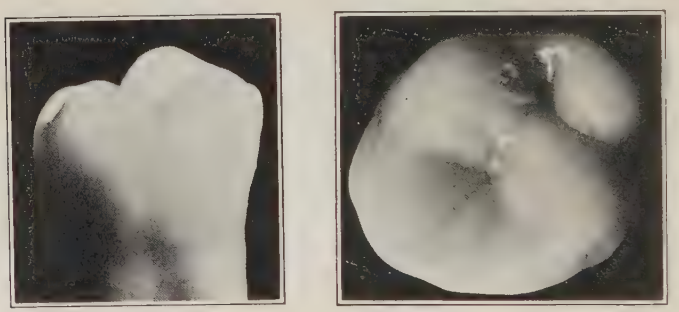
The pathological agencies which produce absorption of the alveolar process are prolonged constitutional disturbances, or diseases of the approximating tissues and continued pressure or stress from mechanical forces.

Since the alveolar process is built during the eruption of the teeth, it can be readily understood that early childhood, while the teeth are erupting, is the logical period for orthodontic procedure.

THE ENAMEL AND THE SALIVA.

The teeth are composed of four tissues: Enamel, dentin, cementum and the pulp. The histology of these tissues is covered so extensively by other sources that reference will here be made only to the enamel, the structure of which has the greatest bearing upon dental prophylaxis. This substance, derived from the ameloblasts of the enamel organ, is made up of inorganic salts, principally phosphate and carbonate of lime, and the water of crystallization. The areas of enamel first formed are those next to the dentin; it therefore develops from within outward. Normal enamel is smooth and dense, and in appearance resembles

somewhat the texture of polished agate. The occlusal surfaces of bicuspids and molars have low cusps, and the enamel plates at the base of the cusps are quite perfectly joined and calcified (Fig. 11). This formation results in smooth, shallow grooves that do not retain food débris. Enamel that is normally free from fissures or deep pits has a high immunity to dental caries. There is clinical evidence to show that the color of teeth has a relation to the incidence of caries, the dark yellow teeth showing a relatively high immunity, and the bluish-white teeth being the most



A *B*

FIG. 11.—*A*, normal enamel; *B*, occlusal aspect, showing shallow grooves.

susceptible to dental caries. Enamel is frequently imperfect in its make-up, as evidenced by imbrications and striations which are regarded as some interference with the normal function of the ameloblasts. When imperfections are present in the enamel structure it is regarded clinically as "soft" as distinguished from "hard" enamel, and it is obvious that it will succumb more readily to the ravages of dental caries than perfectly calcified tissue. Pickerell has demonstrated that poorly formed or soft enamel is porous, and that canals run from the enamel surface to the interior. He found enamel of hard teeth to be compact

and free from such canals, also that before eruption the enamels of all teeth are porous, but that after eruption a process of condensation of the enamel surface occurs. If this condensation is complete the tooth is known as hard or dense, or if it is not so complete it is regarded as soft or relatively porous. He believes that the condensation of enamel is produced by infiltration of calcium salts from the saliva, the completeness of the condensation being dependent upon the degree of calcium-salt concentration in the saliva.

The research work of Bunting includes the determination of the calcium-salt content in a large number of salivas. He reports his work as follows:

"We found that the saliva of every individual contains a definite percentage of calcium which remains fairly constant in amount from day to day. Also that in those mouths in which the teeth are well formed, sound and free from dental caries, the calcium-content of the saliva is uniformly high, while in those cases in which the teeth are soft and carious the percentage of calcium in the saliva is low. So definite and unvariable were these findings which we obtained at that time, and which are constantly being corroborated by cases selected from the college clinic, that we are convinced as to the verity of our original statement, coinciding with the views of Pickerell, that the quality of the enamel and tendency of the teeth to caries are dependent upon the calcium salt content of the salivas which bathe them. Of all other salivary constituents and factors which have been suggested as caries controllers, we have found none which bear so close and definite a relationship to clinical conditions."

This further substantiates the demonstrations of Bodecker,

O. C. Watson
A 1 K

as well as Bunting, which show that the enamel is a permeable tissue.

The saliva is a fluid, extremely variable in composition and amount, but doubtless all the normal constituents are valuable in protecting the teeth and membranes of the mouth from disease. Calcium salt is undoubtedly the most important protective and condensing constituent for the teeth, and any agents which will effectively increase its content in the saliva must be considered efficacious in the production of hard enamel, and consequent reduction of dental caries. The most practical application of this view is one of diet, particularly with children, special emphasis being placed on foods of high-calcium content in combination with those whose vitamins play an important part in calcium metabolism (p. 43, Dietetics). In addition to diet, drinking water rich in mineral salts and the use of mouth washes containing calcium are also helpful. Lime-water mouth-wash is beneficial in that it increases the intraoral calcium content and is a solvent for mucin.

During the period of its formation enamel, being a product of epithelial tissue, is affected by pathological conditions of other epithelial tissues, such as scarlet fever, measles, chicken-pox, etc. These skin eruptions may leave a permanent mark upon the developing enamel, as may any severe disturbance of nutrition. The nature of the defect produced may be a condition of underdevelopment, as evidenced by numerous pits and fissures.

In addition to the effect of certain diseased conditions, enamel may be injured by mechanical causes. These are listed by Hopewell Smith as follows:

1. *Attrition*—resulting from overuse, where the cusps of enamel are worn down and present a hard shiny surface.

2. *Erosion*—associated with chemical changes in the tissues at the gingival margins.

3. *Abrasions*—probably due to mechanical friction, produced by misuse of the tooth-brush, or gritty dentifrices.

Attrition may thus be attributed to a physiological cause, erosion to a chemical cause and abrasion to a mechanical origin.

NORMAL OCCLUSION.

One of the most important phases of dental prophylaxis is the maintenance of correct restoration of the teeth as a masticating machine, since this is their most important function. The dental student should be able to visualize the teeth in normal occlusion, and have a mental picture of the operating of this perfect crushing machine. For this reason the pictures of skulls showing normal occlusion must be carefully studied, and from the preventive side the following points are important: The *interproximal space,* the *contact point* and the *occlusal contact* (Figs. 12 and 13).

The interproximal space is generally triangular in shape, the alveolar border forming the base, the approximal surfaces of the teeth forming the sides, while the apex is at the actual point of contact of the two teeth. It will be noted that the cusps of the occluding teeth in the opposing jaw rest opposite the center of the interproximal space, and were it not for the wise provision of Nature in the arrangement of the contact point the obvious tendency would be to force food into the interproximal space. Hence the function of the contact point.

In the mouth of a living subject the normal interproximal space is filled with gum tissue, or septum. In order to fill the space the septum must necessarily be thicker than other

parts of the gum tissue, and conical in shape. Its apex is, therefore, farther away from the support of the alveolar process, and is very easily injured. Reference has been made previously to the need of protecting this sensitive tissue by maintaining the normal contact point. The sep-

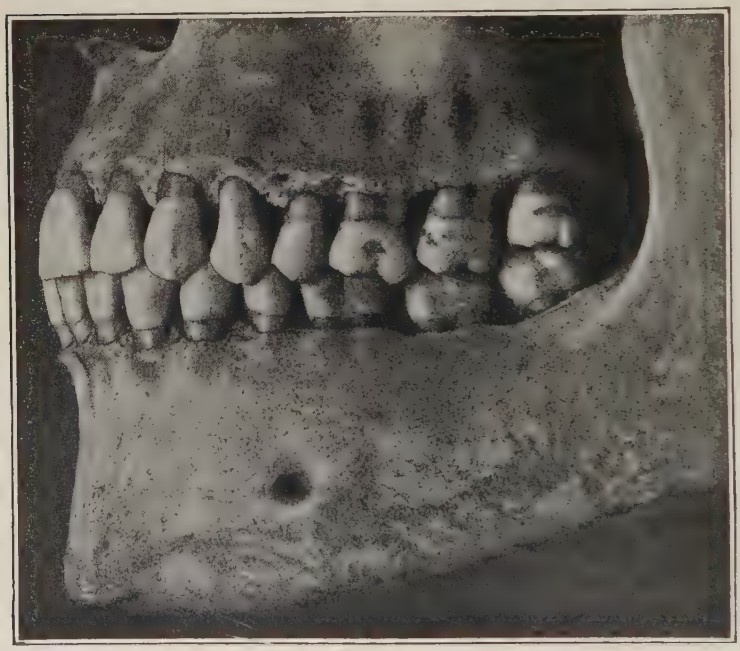


FIG. 12.—Normal occlusion, external view. Note the contact points of the molar and bicuspid teeth and the occlusal contacts. (Peeso.)

tum does not entirely fill the interproximal space, there being a small area between the actual contact point and the apex of the septum. This is an especially vulnerable area for the inception of caries in the ordinary mouth, but in the normal the grinding cusps of the teeth slope away

from this area toward the center of the masticating surface, and the sulci form sluiceways to direct the food away from the interproximal space. The septum itself extends somewhat beyond the interproximal space bucco-lingually, and thus aids in receiving food and carrying it away from this area.

Fig. 13.—Occlusion of molar and bicuspid teeth, internal view. (Peeso).

Adequate protection of the delicate septum and of the interproximal space is provided only when the arrangement of the teeth is normal. In reference to this arrangement it will be noted that the contact points are at a minimum, while any malposition of even a single tooth brings into

contact a greater area, and thereby increases the susceptibility to caries.

A normal denture is self-cleansing, and the normal use of the teeth leaves them reasonably clean. Any perversion of the symmetrical alignment makes self-cleansing impossible, and cleansing by artificial means is also more difficult.

With the exception of the lower centrals and upper third molars, every tooth occludes with two others. Thus, in order to maintain its normality a tooth must be able to function with two antagonists, and the pressure during occlusion should be equally distributed throughout the fibers of the alveolar third of the pericementum. If this fact is kept in mind it will be found that the loss of a single tooth impairs the full usefulness of the two occluding teeth and the two approximating teeth—which makes five teeth in all. The result is impaired efficiency of the masticating machine.

The *occlusal contact* with which each tooth meets the opposing tooth when the jaws are closed is one of the important phases of normal occlusion. Normal occlusal force of contact varies with each tooth in proportion to its function, and the alveolar process is sufficient to withstand the occlusal force which is normal for each tooth. Continued abnormal occlusal stress may result in an increased alveolar structure to meet the strain or in a breaking-down of the supporting tissues. In the latter instance it becomes pathological, and is a causative factor in pyorrhea alveolaris.

CHAPTER II.

BRIEF PATHOLOGY OF THE DENTAL TISSUES.

The foregoing brief résumé of some of the important phases of the normal histology of the dental tissues is necessary in order to analyze the pathological changes which may affect these tissues. *The majority of all the pathological conditions affecting the dental tissues are preventable,* especially if preventive measures are applied during infancy and childhood.

DENTAL CARIES.

Dental caries is a destructive process affecting the hard tissues of the teeth. It is practically universal, and constitutes the most prevalent disease known. Although it has been found in the teeth of skulls many hundreds of years old, all indications point to the assumption that it is a disease of civilization, and that the prevalency of caries is largely in proportion to refining and civilizing the diet of a particular race.

Dental caries is notably a disease of childhood and, according to statistics obtained from the examination of the teeth of thousands of children in this country, it is found that 95 to 97 per cent are afflicted with this disease, while children in the tenth to twelfth year average more than seven cavities apiece. The period of childhood is thus considered as that of the greatest susceptibility.

Although many theories have been advanced regarding

the etiology of dental caries, the theory of Prof. W. D. Miller, published about 1885, is generally accepted at the present time. It is possible that this theory will be revised in view of the findings of modern research.

The important points in Miller's, or the chemico-parasitic theory, are:

1. That dental caries has its inception externally, and never from within the tooth.

2. Certain organisms of the mouth, acting upon carbohydrate food débris, produce lactic acid by fermentation processes.

3. The lactic acid primarily attacks the mineral matter present in the interprismatic cementing substance, resulting in the disintegration of the enamel.

4. If unchecked the dentin is attacked, the microörganisms penetrating the dentinal tubules.

5. When decalcification has thus taken place the exposed organic matrix of the tooth is attacked by a different type of microörganism, the proteolytic bacteria. This results in the disintegration of the organic matrix by putrefactive processes.

Briefly stated, the two essential factors for the initial stage of dental caries are, according to Miller, the presence in the mouth of fermentable carbohydrates and lactic-acid-forming microörganisms.

There are certain areas of the teeth which are known to be particularly susceptible to caries, especially the surfaces not exposed to the friction of the tongue, lips and cheeks. The selected location of caries is wherever carbohydrate food débris can find an undisturbed lodgment, such as in pits or fissures of the masticating surfaces and the approximal surfaces of the teeth. It is a clinical fact that about 60 per cent of dental caries occurs on the occlusal surfaces

of molars and bicuspids. Therefore, the operative measures for prevention should be applied particularly to these surfaces. It should also be understood that fissures are faults occurring during the development of the tooth resulting from an imperfect union of the enamel lobes. It is believed that fissures are caused by a disturbance of metabolism. Thus, the correct regulation of the prenatal diet, and that of young

FIG. 14.—A deep, open groove.

children, constitutes to a great degree the true prevention of the high susceptibility to dental caries found in the occlusal surfaces of molars and bicuspids (Figs. 14 and 15).

The susceptibility of each individual is therefore in this regard largely a result of the formation of the teeth, and their relation to each other in the arch—those approximating the normal being the least liable to decay.

Dental caries is a distinctly localized process and, although the form and relation of the teeth determine to a great degree the localization of the carious process, there is still another factor to be considered—the bacterial plaque. This complicating factor was pointed out by Dr. J. Leon Williams, who showed that the fixation of lactic acid producing bacteria and food débris upon the tooth surfaces is brought about by the precipitation of mucic acid from the

Fig. 15.—A split tooth, showing caries beginning in an occlusal fissure. *The finest explorers should be used to determine the presence of occlusal defects.* (Noyes.)

mucin in the saliva. The formation of the bacterial plaque may be described briefly as follows:

The fermentation of carbohydrates by the bacteria results in free lactic acid, which decomposes the mucin of the saliva and precipitates adhesive mucic acid. The mucic acid envelopes the colony of microörganisms and the carbohydrate food débris, literally cementing them to the tooth surface. This mass of bacteria and food débris adhering

to the surface of the tooth is the bacterial plaque, and under its protective covering the lactic acid is intensified and caries progresses undisturbed. The plaque may thus be regarded as the initial cause of dental caries, and as the essential factor in its localization (Fig. 16).

FIG. 16.—Showing bacterial plaque, and beginning caries on approximal surfaces. *The frequent removal of plaques and other accretions from the surfaces of the teeth is important to the prevention of dental caries.* (Miller.)

The logical deduction would seem to be then that the prevention of dental caries lies chiefly in those measures that will prevent the formation of the bacterial plaque or effect its removal before the disintegration of the enamel can occur. The principles of prevention of dental decay have been based on this deduction, with the result that

extreme cleanliness of the tooth surfaces has effected a marked reduction in the incidence of caries in the majority of cases, but the problems of immunity and susceptibility are still unsolved.

Immunity and Susceptibility—Although it has been frequently proven in private practice that 70 to 90 per cent of dental caries can be prevented by intensive prophylaxis and rigid mouth cleanliness, every practitioner knows from clinical experience of seemingly clean mouths which are ravaged by dental caries and unclean mouths, with teeth covered with plaques and fermenting carbohydrates, showing a high degree of immunity.

The most recent researches into the problems of immunity and susceptibility point to the diet as the great controlling factor. Among these are the researches of Wallace, Pickerell, McCollum, Grieves, Howe and many others. These investigators are agreed that susceptibility or immunity to dental caries is closely related to the dietary, although they do not all concur in their conclusions as to wherein that relationship lies.

A study of the food habits of races, such as the Esquimo, the African negro, the peasant farmers of Europe, the South Sea Islanders, the Maoris, who have a relatively high immunity, shows in each instance that the food supply is unrefined and natural to their various climates. A comparison with the refined and unnatural dietaries of modern civilized nations, in each instance highly susceptible to dental caries, undoubtedly furnishes the solution to the fundamental cause of this malady. In the succeeding pages the dietetic considerations in relation to this and other forms of mouth pathology will be outlined.

DIETETICS.

Elements of the Human Body—The elementary composition of the human body may be given approximately as follows:

	Per cent.		Per cent.
Oxygen	65.0	Potassium	0.35
Carbon	18.0	Sulphur	0.25
Hydrogen	10.0	Sodium	0.15
Nitrogen	3.0	Chlorin	0.15
Calcium	2.0	Magnesium	0.05
Phosphorus	1.0	Iron	0.004

Iodin, Silicon, Manganese, Flourin } Minute quantities.

These may be termed the *elements essential to life*, for they enter into the composition of the entire plant and animal kingdoms. In human metabolism more or less of these elements are utilized and eliminated daily, and if body health is to be maintained an equal amount must be furnished daily in the food supply.

Protein or nitrogenous foods are formed mainly from five elements—carbon, hydrogen, oxygen, nitrogen and sulphur. They are utilized by the body cells to repair waste and to build up cells and intercellular structure.

Carbohydrate foods are formed from carbon, hydrogen and oxygen, and furnish the most abundant and economical sources of energy.

Fats or hydrocarbon foods are formed from a different arrangement of carbon, hydrogen and oxygen (contain less oxygen than the carbohydrate group). They constitute a more concentrated form of fuel which is stored for future use.

These are generally considered the three great groups of the food supply, but erroneously so, since they contain but five of the sixteen elements essential to life.

The balance of the *inorganic and organic elements* in foods have many important functions both individually and in combination. Some of the most important of these, according to Sherman, are:

1. As bone and tooth constituents, giving rigidity and relative permanence to the skeletal tissues.

2. As essential elements of organic compounds, which are the chief solid constituents of the soft tissues, as muscles, blood cells, etc.

3. As soluble salts held in solution in body fluids, and giving these fluids their characteristic influence upon the elasticity and irritability of muscle and nerve.

4. Supply the material for the acidity or alkalinity of the digestive juices and other body secretions.

5. Maintaining the neutrality or slight alkalinity of the internal fluids.

6. Maintaining the osmotic pressure and solvent power of internal fluids.

The food elements which perform these most important functions are variously termed "ash constituents," "mineral salts" or "inorganic elements." Since none of these terms adequately covers the entire group, the term "mineral matter" will be used here as more nearly correct, for they are all reduced chiefly to mineral matter during body metabolism and are excreted as such

These elements exist in foods as:

Calcium, essential to bone, tooth and blood formation, a necessary factor in the coagulation of the blood, a regulator of the action of the heart muscles. It is further an absolute necessity to normal digestion and to the maintenance of the neutrality or alkalinity of body juices.

Phosphorus, strictly essential to every living cell in its nucleus, and thus to all of its cellular structure. In

combination with calcium it is highly important in tooth formation.

Potassium, essential to the soft solid tissues, as the protoplasm of muscles and other organs, the corpuscles of blood, and the highly specialized fluids secreted by certain glands, as milk.

Sodium occurs abundantly in blood and other body fluids, and is particularly necessary to proper digestion.

Sulphur, important to the life of the hair and nails, and present in bile.

Iron, a constituent of the hemoglobin of red blood corpuscles and a carrier of oxygen upon which all energy-yielding processes of nutrition depend. It is found in the gastric juices, in the pigment of skin, hair and in the eye.

Manganese occurs in combination with iron as an important element in the blood.

Magnesium in combination with calcium is an essential element in bones and teeth.

Fluorin in combination with calcium and magnesium is necessary to enamel and bones.

Chlorin, present in blood, and an important element in the hydrochloric acid of the gastric juice.

Iodin, important to the proper functioning of the thyroid gland.

Only a brief reference has here been made to the many vital functions performed by these elements which are often discarded from the prepared foods of civilized man. The food supply, in addition to furnishing the sixteen elements essential to life must also supply the antiscorbutic, antineuritic and growth-promoting factors known as *vitamins—the fat-soluble A and water-soluble B and C*.

There is a wonderful provision by which Nature designs the vegetable cell to meet the requirements of the animal

cell, and all *natural* foods when combined in a mixed dietary supply the sixteen elements essential to life and health, as well as the vitamins.

Natural foods are raw milk, and eggs; all fruit, nuts, berries and honey; all vegetables; all entire grains, as whole wheat and oats, brown rice, entire rye, unpearled barley, etc.

The foods listed above provide every element essential to the perfect nutrition of man, and it is also of great importance to realize that the elements in all these foods occur in the chemical and physiological balance necessary to perfect utilization in the body. It may then be stated that natural foods supply:

1. Every element essential to the health and life processes of the human body.
2. All the vitamins necessary to the nutrition of man.
3. Coarseness and fiber for vigorous mastication with its attendant benefits.
4. A perfect chemical balance, which maintains the normal neutrality or slight alkalinity of body secretions.

In a natural state all foods deteriorate rapidly, being equally good food for bacteria as for man. This is a further provision of Nature to insure a food supply that is fresh and vital, in which form the elements are most perfectly utilized by the cells.

A study of the food habits of all immune peoples will show the use of some of these natural foods in various combinations, and when the commercial processes of refining creep in the degree of immunity must decrease in that proportion.

From the dental standpoint the most important elements are calcium and phosphorus, since teeth are composed chiefly of calcium phosphate. The amount of this material available in physiological balance for tooth formation regu-

lates to a great degree the hardness and density of enamel. Clinically it is known that immunity to caries is usually coincident with dense tooth structure.

The almost universal susceptibility to dental caries, as well as numerous other common diseases, is the logical result when the food supply of civilized nations fails, as it does, to provide the sixteen elements essential to life and health. Not only are the elements lacking to build sound tooth structure, but refined starches and sugar are ever present in the diet to attack the inadequate defense of soft or imperfectly formed enamel.

If, as it seems highly probable from the researches of Pickerell, Bunting and others, the composition of saliva is a factor in immunity or susceptibility, it may be readily understood that a dietary which fails to supply sufficient calcium in a physiological form for perfect tooth structure fails also to provide this and other elements for normal saliva. Previous reference has been made to the function of the mineral elements in maintaining normal neutrality or slight alkalinity of body secretions, including saliva. Under dietary conditions, in which many of these elements are lacking, the saliva may not only fail to provide calcium salts sufficient for hardening the enamel of the teeth which it bathes, but may actually be of acid reaction, and thus a menace to the enamel with which it is in constant contact.

THE UNNATURAL DIETARY OF CIVILIZED NATIONS.

In spite of the food in a perfect state, which Nature has designed for normal nutrition, growth and health, civilized man, in defiance of all natural laws, has perverted this normal food supply through ignorance, greed or commer-

cialism, and reaped a reward of malnutrition, with consequent diseases and defects.

Refined and processed foods are:

1. Wholly or partly robbed of the elements for building perfect tissues. For example, entire wheat which is a natural cereal food appears after milling processes as white flour. During the milling more than three-fourths of its mineral salts are removed, including calcium and phosphorus. An almost pure starch remains, with a little protein. The natural brown rice kernal, during the polishing process to produce white rice, is robbed of its salts in a like manner, and this is true of all the grains, as pearled barley, degerminated corn meal and refined rye.

2. Acid-forming, because the alkaline mineral elements are removed. An excess of refined foods produces acidosis—a condition which indicates that the blood is unable to secure enough base-forming elements to maintain its normal neutrality or slight alkalinity. The result is lowered resistance and susceptibility to infection. Examples of modern foods which are acid-forming are all refined starchy grains, as white flour, hominy, farina, cream of wheat, white rice, tapioca, corn starch and white sugar.

3. Wholly or partly lacking in vitamins. Vitamin B is removed with the germ of all refined grains and cereals. Much of the vitamin-content of normal milk and butter is destroyed in pasteurized milk and pasteurized butter. All three vitamins are lacking in white flour, corn flour, polished rice, white sugar and lard.

4. Not in physiological balance and, therefore, cannot be perfectly utilized by the tissues. In all Nature's food supply no instance can be cited in which a given food is purified starch, purified sugar or protein. Many natural foods show a preponderance of the particular group of food

elements which form protein, carbohydrates or fats, but the elements are always intricately arranged with many others in smaller proportions but highly essential to the physiological balance of the food. For example, honey is a natural food, and one which shows a preponderance of the carbohydrate group of elements, but contains also some protein, many mineral salts and vitamins. In contrast, white sugar which lacks these essentials is a pure disaccharide—a product which never occurs in Nature. Sugar-cane and beets are both natural foods, serving an important place in the dietary until modern refining extracts the purified sugar and discards the balance of the food elements. It can readily be understood how many foods which are prominent in the dietary are destroyed in physiological balance in this way. Further examples are white flour, corn starch, lard and many others.

5. Soft and pappy, so as to require little or no mastication. The teeth and jaws do not have proper function because the coarseness and fiber of the food has been removed. In addition, the lack of bulk or residue predisposes to constipation, one of the most serious effects of refined foods.

6. Not only lacking the elements for building strong teeth, but the continuous presence of refined carbohydrates in the mouth results in rapid lactic acid fermentation, which attacks the poorly formed enamel. If refined foods were simply not helpful to perfect tooth formation the menace would be serious enough, but in addition to this their presence in the mouth is actually harmful.

7. Lifeless, and so lacking in vital elements that they keep indefinitely. Bacteria, germs and insects scorn the degerminated and refined articles called "food" that civilized peoples consume by the hundreds of tons. In all Nature no food is produced that will keep fresh and edible for any length of time.

MODERN METHODS OF PREPARING AND COOKING FOOD.

In addition to the processing and refining of all cereals, grains and sugars, the average housewife innocently contrives to lose many valuable food elements through ignorant methods of preparing and cooking vegetables and fruits. As in the case of the grains, much of the mineral salts of fruits and vegetables occurs in the outer covering. For this reason the skins as well as the juices of vegetables and fruits are most valuable. A baked potato is rich in many essential elements, especially if the skin is eaten, while a peeled boiled potato drained of the cooking water is practically pure starch, and lacking its original balance for nutrition. The water in which any vegetable or fruit is cooked may be considered as containing the most vital portion of that particular food, and should always be utilized in soups or sauces. Very little water should be used, and steaming or baking is preferable to boiling.

The vitamins in food are destroyed by long cooking. For this reason vegetables should be cooked at the boiling-point and only until tender. Whenever possible fruits and vegetables should be eaten raw while fresh and tender.

In relating the methods used to prepare foods among the uncivilized races, who show a high immunity to dental caries, Pickerell states that whenever food was not eaten raw it was wrapped in large leaves to retain the natural juices, and cooked by steaming or baking. This is doubtless a most important point, and can be made to apply to modern methods of cooking by utilizing casseroles, steamers and double-boilers.

Knowing the elements essential to the development and health of the human organism, it is now possible for the

student to comprehend some of the modern dietary factors that are conducive to poorly formed teeth and other tissues, and susceptibility to dental caries and other physical defects.

THE DEVELOPMENT OF THE HUMAN EMBRYO.

During the prenatal period the growth and development of the embryo is dependent entirely upon the contents of the blood of the prospective mother. The contents of the mother's blood are dependent upon what she eats. Not only is she required during this period to keep her own body in physiological balance, but there must be sufficient additional intake of the essential elements to form a perfect body for the child. Especially important is the calcium and phosphorus intake since her normal needs must be supplied as well as the high calcium and phosphorus requirement of infancy.

Typical Prenatal Diet.—The average heavy meal in American homes is represented chiefly by meat, boiled potatoes, white bread, white sugar, pastries, tea or coffee, and none of these foods contain an appreciable amount of calcium or phosphorus. In fact, they are practically mineral-free and are acid-forming, as are all the so-called foods which are refined for commercial reasons, or prepared incorrectly at home. Where is the prospective mother to obtain these precious elements? Not from white rice, degerminated corn meal, refined cereals and sugar, not from peeled boiled vegetables and not from meat. With a dietary in which these articles occupy a prominent place, her blood has a struggle to maintain its integrity and to supply the insistent demand for the essential elements. Eventually the cells of the mother are called upon to reorganize her tissues and to

surrender some of their precious elements. This undoubtedly is done, but much to the detriment of her bones and teeth. The increased susceptibility to caries during pregnancy is significant in this respect. Child-bearing becomes a serious process under these conditions, almost as unnatural as the food supply upon which the mother and baby are trying to thrive.

There is a saying that you cannot build a brick house without brick, neither can you build good teeth without calcium and phosphorus in physiological balance. The crowns of the deciduous teeth are already formed when the baby is born, and the mother's diet is the deciding factor as to whether or not these teeth are dense and perfect in structure. Even the cusps of the first permanent molars are in process of formation at this early period, so that the prenatal diet has its influence upon the permanent teeth as well. The soft carious deciduous teeth of early childhood and the imperfectly formed first permanent molars are proof positive of the prenatal diet lacking the essentials for strong teeth and a healthy body.

Dietary Essentials for the Prenatal Period.—No further analysis is required to show that natural foods are absolutely essential during this period. A brief outline is given of the foods that should constitute the bulk of the diet.

1. *Milk.*—This should be certified raw milk when possible. The amount should be 1 pint daily for the first four months, increased to 1 quart daily for the balance of the prenatal and *nursing periods.* For persons who find milk agreeable 1 quart daily is ideal through the entire period, but meat consumption should be considerably reduced. It should be considered that milk is an absolute essential at this time, as well as fresh butter.

2. *Whole Grain Cereals and Bread,* such as natural brown rice, entire wheat flour cooked as cereal, cracked whole wheat, Scotch or Irish oats, whole corn meal mush. Some whole-grain prepared cereals may be used occasionally, as Ralston's, Pettijohn's or Shredded Wheat.

Bread or muffins should be made from whole wheat, entire rye or fresh ground whole corn meal. Toasted Triscuits or Wheatsworth crackers may be used for variety.

3. *Eggs and Home-made Cottage Cheese.*—These are valuable foods and make good substitutes for meat, which should be eaten sparingly. Sea foods, chicken or lamb eaten once daily provide ample protein.

4. *Fresh Vegetables.*—An abundance of fresh vegetables, including a baked potato, two additional baked or steamed vegetables and two raw vegetables. Raw salads daily must be considered absolutely essential to the diet.

5. *Fruit.*—Some fruit daily—and fresh raw fruit whenever possible. For constipation the addition of cooked fruit once or twice a day will be most helpful. Entire grains and bulky salads are very essential to remedy this condition.

6. *Natural Sweets.*—Honey, pure maple syrup or sugar, real molasses, dark-brown sugar, figs, dates, raisins and sweet fruits.

At least 3 pints of water or other liquids should be taken daily. Vegetable soup with brown rice, and cream of vegetable soups are valuable additions.

This list contains all the elements essential to the developing fetus and for nourishing the tissues of the mother. It should be continued during lactation.

Every dentist should consider it a routine of dental prophylaxis to advise prospective mothers regarding the dietary essentials for good teeth and healthy bodies.

BABY AND PRESCHOOL AGE FEEDING.

Nature intended that all babies should be breast-fed, and it is stated by good authorities that every mother *can* nurse her baby. In rare instances, such as cases of grave systemic infections, like tuberculosis, the baby should not be breast-fed, but the numerous other excuses given for depriving an infant of its natural food are used either because a mother wishes to evade her duty or because she receives wrong advice when for some reason her ability to nurse the child or the desirability of doing so are in question.

The quality of breast milk has never been satisfactorily proven to be unsuited to the baby for whom it is intended and analysis of the milk is unreliable because of its variability at different stages of the individual nursing period, as well as at different times of the day. In the majority of cases where artificial feeding is resorted to, the *quantity* of breast milk has been insufficient. The chief cause of insufficient quantity of milk is the failure to thoroughly empty each breast at regular intervals. Any farmer knows that "milking makes milk," especially if completely done at systematic hours. A robust nursing baby accomplishes the object of not only working hard for his food, with attendant beneficial results, but also completely empties the breast at each feeding thus stimulating the mammary gland to further secretion. On the other hand, when an infant is unable to produce adequate suction, or the breast yields milk with difficulty, the effect upon the gland is a reduction in the quantity of milk and eventually no milk is secreted. Such cases invariably respond to artificial expression of the milk if done regularly, by an increase in the flow of milk, and the subsequent establishment of an adequate supply of natural

food for the baby. The technique for the developing or increasing of breast milk by manual expression is outlined by Dr. C. Ulysses Moore, in his book on "The Nutrition of Mother and Child."

The desirability of breast feeding may be summed up under one heading—it is the only natural food and there can be no adequate substitute. There are, doubtless, many advantages to the mother and child that are not known at present but some that are well recognized in breast milk are:

1. It is chemically balanced, and free from bacteria.

2. It provides *natural immunity* to disease. Wassermann found that a drop of blood from a breast-fed baby will kill ten times as many bacteria as a drop from one who is bottle fed.

3. It supplies the only adequate materials for building good teeth in infancy.

4. The mechanical act of nursing provides for the muscular exercise necessary to the development of normal jaws—a similar effect is produced in all the head muscles, to aid in the natural growth of the nasal passages and the brain case.

From the experiments quoted on page 64 (Dr. Baker's) it would seem that breast-fed babies not only have greater chances of physical strength but mental capacity as well, since the inadequate use of the masticatory muscles produced a cramped and unevenly developed brain case.

It may well be considered that the greatest calamity that can befall an infant is to be deprived of mother's milk.

The increasing number of artificially-fed infants presents a serious problem from the tooth standpoint as well as the general health. Large cities have necessitated the pasteurization of milk, so that pasteurized modified cows' milk is widely used as an artificial food. It is only possible to touch briefly upon this situation, but there can be no doubt

that it will bear serious consideration in regard to the formation of the permanent teeth.

Pasteurization undoubtedly destroys more than the antiscorbutic properties of milk. The process is unnatural and the chemistry of the changes is unknown, so that it is difficult as yet to determine the actual result. Several clinical facts should cause us to look upon the efficacy of pasteurized milk with skepticism. The liability to scurvy during its use is well known. There is apparently a detrimental effect upon the activating agent for the deposition of calcium. Medical investigators report that the roentgen-ray as well as a large number of autopsies show that there are few infants who do not present symptoms of rickets to some degree. Compare this to the immense numbers of poorly constructed teeth among children of school age, and a very significant analogy is found. Rickets is a nutritional disease characterized by changes in the bone structure, due to imperfect calcification, with subsequent deformity. In addition to this muscular weakness and nervous disturbances develop. The same metabolic disturbance which prevents the perfect calcification of bones will prevent the perfect calcification of teeth, and, conversely, the factors in normal blood which stimulate deposition of calcium in bones will stimulate deposition of calcium in teeth.

Dr. Edward A. Park, of Yale Medical School, lists four methods by which deposition of calcium phosphate can be secured, as follows:

1. By administration of cod-liver oil.
2. By direct rays of the sun or ultraviolet rays.
3. By starvation.
4. By correct feeding, to preserve the normal relation of salts in the blood.

In respect to the last method, he states: "Even when

active light and the essential contained in cod-liver oil are denied, rickets cannot result if the optimal salt balance of the diet, in particular as regards calcium and phosphorus, is maintained." And yet the conclusion Dr. Park draws is that rickets, as well as dental caries, will be eliminated when all babies are exposed to sunlight and fed cod-liver oil during the first three years of life. We shall soon believe that cod-liver oil is a natural food without which babies cannot thrive.

This significant fourth statement regarding the immunity produced by a diet which contains the optimal mineral salt balance seems of the greatest importance. If mothers taking a natural diet produce normal breast milk, and if after the weaning period the child's diet continues to provide the optimal salts balance, conditions are indeed favorable for the perfect calcification of bones and teeth.

It does not seem that Nature intended we should be dependent upon the cod-fish to raise children with good bone structure and sound teeth, although as a prophylactic measure it is justifiable to use cod-liver oil to offset the ill-effects of an erroneous diet. This great problem can never be solved by any such palliative measure.

Some mention must here be made of the widespread use of proprietary baby foods on the market, which misinformed physicians or mothers hail as substitutes for breast milk or cows' milk. An analysis of these foods shows that they frequently do not even attempt to simulate the composition of breast milk, but contain an abnormally high percentage of starch and sugar and incorrect proportions of fats and proteins. One of the most popular of the proprietary baby foods shows under analysis that it is white flour which has been heated to convert some of the starch into sugar. The carbohydrate of this food will undoubtedly cause a steady

gain in the baby's weight and, therefore, seems entirely satisfactory to the mother; but from the standpoint of forming the permanent teeth, the food is inadequate. Further, in bottle feeding, the milk flows freely through the nipple with very little muscular effort exerted by the baby, and so fails to provide the functional stimulation necessary to develop the jaws, nasal passages and brain case. In many cases the results are a narrow arch with crowded teeth, and respiratory defects, such as enlarged tonsils and adenoids. Thus, it is that the thunder comes so long after the lightning, and it is difficult to realize that a fat and apparently healthy baby may in ten years present defects that can be traced to the unnatural food supply of early life.

If a baby has been so unfortunate as to be artificially fed, it might be reasonable to hope that once the weaning period was reached a more satisfactory diet would be arranged, but a perusal of the recognized books on the feeding of young children will help to further clarify our dental problem. The first additions to milk are gruels from patented or pearled barley, commercial oat meal or white rice. This list is later enriched by the addition of cream of wheat, farina and hominy—all demineralized, refined and chemically unbalanced cereal products; boiled macaroni, dry white bread, toast, soda crackers and pilot biscuits are also included—all white flour products, and consequently acid-forming. Several kinds of meat are advised and, although this is beside the point, the attention must be directed to the hazardous custom of giving a young child scraped raw beef and beef juice from practically raw meat and at the same time enforcing the pasteurization of milk to prevent infection from diseased cows. Further, the nutritive value of meat broths is open to question, while vegetable broths are far superior and certainly safer. To sensible desserts

of raw or cooked fruits are added corn starch and tapioca in pudding—two more examples of "foodless foods." By the second year small amounts of mashed boiled vegetables are given, and milk is excluded from the heavy noon-time meal. Through the entire period the refined cereals form the main dish of the morning and evening meals, and it is quite common to find children seven or eight years of age who are required to follow this custom. During this important formative period the child's body is starved for calcium phosphate and fattened with starch and sugar.

SUGGESTIONS FOR DIET RICH IN ESSENTIAL ELEMENTS.

If a substitute for the mother's milk must be used cows' milk, correctly modified, is the most satisfactory. Whenever possible it should be certified raw milk. Milk sugar is the most natural addition used to increase the carbohydrate content. When cereal dilutent is used it should be made from whole-wheat flour and strained through a boiled cheesecloth. The fresh juice of orange, tomato or cabbage is valuable for vitamin content.

When milk ceases to be the only article of diet the first additions are fruit juices and cereal gruels from whole grains, as Scotch or Irish whole oats, natural brown rice, whole barley or whole wheat; vegetable broths and purées furnish essential mineral salts, and are a most important supplement to milk. Later additions are egg and baked potato. Junket, custard, prunes, baked apple and apple-sauce should be sweetened with honey. Babies and children should never be fed refined sugar.

Recent experiments of Sherman have shown conclusively that children from two to twelve years of age require 1 quart

of whole milk daily, to secure the optimal quantity of calcium required during that important growth period. He proved that the addition to the diet of all vegetables of high-calcium content did not compensate for a reduction in the amount of milk. The slogan, "A quart of milk a day for every child," could be used to great advantage by every dentist who comes in contact with mothers and children. This amount of milk should be disposed of by drinking at each meal, on cereals, in cream soups, milk puddings, and cottage cheese.

DIET FOR THE SCHOOL CHILD.

The diet suggested for adults during the period of pregnancy and lactation is most suitable for the child of school age. It is especially planned to furnish foods that are well balanced in all respects, and provides liberal amounts of all the elements so essential to growing bodies, and developing permanent teeth.

In many homes where the utmost care has been exercised over the feeding of the baby and young child, little or no attention is given to the diet of the child of school age. He eats with the family and partakes of the usual meat, potato and pastry meal. Too frequently the periods between unsuitable meals are seemingly brightened with sweet crackers, jelly, candy, ice-cream cones and soda water.

THE RELATION OF REFINED DIETS TO DECAYED TEETH, MALOCCLUSION AND OTHER PHYSICAL DEFECTS.

Some conception can be gained of the dietary handicaps under which the body of the growing child is laboring to produce a perfect structure from imperfect materials. It

is not so remarkable, then, that children in the first and second grades should be starting their school life under such physical handicaps as decayed and abscessed deciduous teeth, and it is difficult to find one child out of a hundred who is free from physical defects. Defective teeth and malnutrition head the list of physical defects noted, and 40 per cent of these children have defects of the nose and throat; 20 per cent, defects of the skin; while eyes, ears, chest, back and feet are found defective in smaller percentages. These children are susceptible to colds, to constipation, to measles, mumps, chicken-pox, whooping-cough and other so-called mild diseases of childhood.

A reference should here be made that malocclusion is present in approximately 95 per cent of older children. There is a strong analogy between the tendency to rickets in babyhood and the underdeveloped and malformed jaws of later childhood. If the growth elements are lacking in the diet rickets, poorly constructed teeth and underdevelopment of jaws may follow. Orthodontists must seriously consider this phase of malocclusion. The use of refined foods is further important in this connection in that they are soft, so that little or no mastication is required. With imperfect nutrition of the dental tissues and lack of function the proper development of the mandible and maxillæ is impossible.

The faulty nutrition of the average preschool child must now be apparent as we consider the various departures from the normal that are to be noted in the youngest school child. It must be emphasized especially that any departure from the normal does not exist singly, even though the cursory examination may not disclose more than one defect. The interdependence of body tissue and secretions makes such a condition impossible, yet dentists have concentrated on

the most conspicuous dental defects and ignored their true significance. Teeth that are soft in structure, malformed, possessing defective surfaces and are mal-occluded, must be recognized as a cardinal evidence of generally defective bodily tissue, for it cannot be that imperfect tooth structure is ever present as an abnormality in an otherwise healthy body. Conversely, the immunity from dental defects is an indicator of normal physical development, with corresponding immunity to all disease. In the examination of 6000 children at the Forsyth Infirmary, Pollini found that 11 per cent who were free from dental caries and malocclusion had been totally free from disease, and showed physical, mental and nutritional balance. The remaining 89 per cent showed the usual amount of caries and malocclusion, and all had had the infectious diseases. Not only are sound teeth and well-developed jaws dependent upon the prenatal and preschool feeding, but a sound body as well is primarily dependent upon correct diet.

Supplementary Reading Suggested for Students.

1. The Science of Eating—Alfred W. McCann, Doran & Co.

2. What to Eat and How to Prepare It—Elizabeth Moneghan, Doran & Co.

3. The Newer Knowledge of Nutrition—E. V. McCollum, Macmillan Company.

4. Nutrition of Mother and Child—C. Ulysses Moore, Lippincott Company.

5. Diet—The Way to Health—R. S. Clymer, Published at Beverly Hall, Quakertown, Pa.

6. The Chemistry of Food and Nutrition—Henry C. Sherman, Macmillan Company.

MALOCCLUSION OF THE TEETH.

The etiology of malocclusion of the teeth is obscure to a certain degree, but it may be stated that the most important known causes of underdevelopment of the jaws and the resulting malocclusion are *lack of function* and *improper diet.* It is one of the immutable laws of Nature that proper functioning of any part of the body contributes to the normal development of the part, while in lack of use there results underdevelopment and even atrophy. In infancy normal function and proper diet comes through breast feeding. Applied to the teeth, their most important function is the breaking-up of food material in preparation for digestion, and the jaws, being the supporting bony structures of the teeth, develop in response to the normal use of these organs. Not only must the bulk of the food consumed be such as to require the fullest use of the masticatory apparatus, but this apparatus must be able to function normally in response to demand. Previous reference has been made under Dietetics to malocclusion as an almost universal malady present in children of school age. Subsisting, as they do, upon food which is so refined and processed that the natural fibers, or coarseness, which calls for the greatest masticatory pressure, are removed, the proper functioning of the jaws and teeth is impossible. It has been shown that, by the same methods of refining, the food is also demineralized, so that the growth elements essential to normal development of the jaws are lacking.

Primarily, then, the diet is faulty both because it does not provide the sufficient growth elements for normal jaw development and lacks many coarse hard foods requiring pressure to masticate (Figs. 17 and 18).

An additional cause for lack of use is badly decayed or

abscessed teeth which make chewing painful or at least difficult. Under such conditions a child must either bolt his food or select only soft food that does not require chewing. In cases of this character, especially when the ability

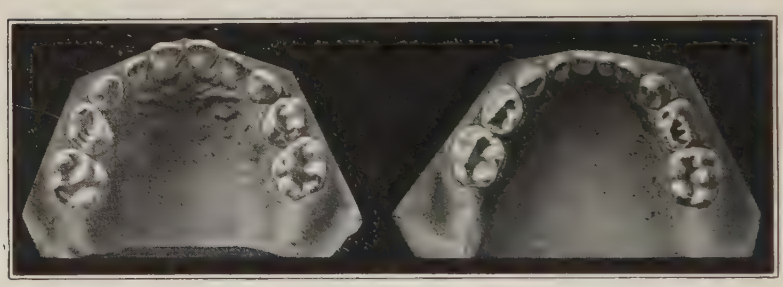


FIG. 17.—Normal growth of dental arches at four and a half years. (Ottolengui.)

to masticate is confined to one side of the mouth, the resulting irregular development of the jaws is but half of the pitiful result, as shown by the following report of a demonstration by Dr. Laurence W. Baker, of Boston.

FIG. 18.—Lack of growth in dental arches at five years of age. (Ottolengui.)

"Among the first voluntary coördinate muscular actions of a human being after coming into the world is that made with the muscles of mastication in taking food to sustain

life. Long before the infant can hold up its head, or has gained control over those useful organs, the hands, the muscles of mastication are highly developed and are used with great vigor.

"During the act of nursing the action of this set of muscles is so vigorous that it demands an increased blood supply, to the extent that the heart's action is greatly increased; the excessive flow of blood to these parts is indicated by a reddening of the whole head, and the fontanelles themselves are caused to pulsate so that the untrained observers comment on their movement.

"Later, with the advent of the dental equipment, this group of muscles is given more leverage, and its action becomes consequently more powerful; in fact, the force exerted on the bones of the head from the pull of these muscles during life is tremendous and amounts to many hundreds of thousands of tons of force. I have long been convinced that this great force on the skull, and the great flow of arterial blood to the head caused by this muscular activity, is a powerful influence in the development of the bones of the head and the important organs incased therein.

"It occurred to me that if the hypothesis regarding the influence of the dental equipment on the formation of the bones of the head were correct, interference with the laws of occlusion in the lower animals would show consequent effect in the formation of the bones of the skull; and if variation occurred it might throw some light on the most complex problem of the development of the human head.

"To test the theory the following experiment was performed: A litter of 4 rabbits was selected at the age of weaning. Two of the animals were operated on by grinding down all the teeth on the right side of the lower jaw and the superior right central incisor. As the teeth elongated,

repeated grinding rendered them useless, so that all the mastication was performed on the left side. The fourth rabbit was kept in the normal state for a standard of comparison.

"After seven months the skeleton of one of the rabbits was procured, and the skull was found to vary as shown in

FIG. 19.—The upper aspect of the skull of a rabbit whose teeth were ground on the right side. Note the unequal development of each lateral half of the skull. (Baker.)

Fig. 19, which is a photograph of its upper aspect. It will be noted by the drawn lines that there is a deviation of the bones to the left. (Right and left in this description refers to the right and left side of the animal.) The suture between the parietal and frontal bones does not run strictly at right

angles to the longitudinal axis of the skull; the right frontal bone projects farther forward than the left one. It will also be observed that the left zygomatic space is longer and more advanced than the right space. The most noticeable deviation is in the nasal bones, both bones being twisted to the left.

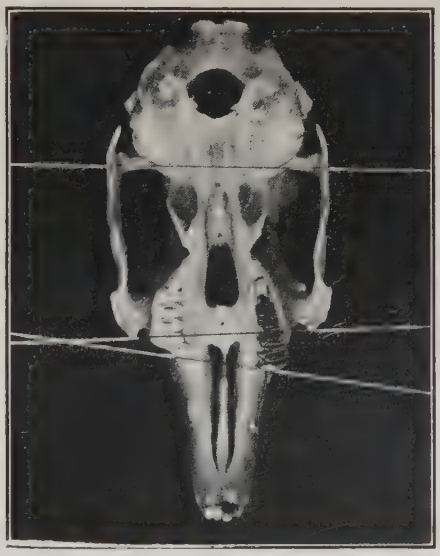


FIG. 20.—Lower aspect of Fig. 19. (Baker.)

"On the lower aspect of the skull (Fig. 20) it will be seen that the deviation extends throughout the entire skull. The most remarkable deviation is that the anterior root of the right zygomatic arch (the zygomatic process of the maxillary bone) is retreated while the bone of the right maxillary bone itself with the teeth that it contained is greatly advanced.

"The results of this experiment seem remarkable to me.

"Who would have thought that by interfering with the laws of occlusion the skull would have decreased in weight, and that every suture and every bone in the head would have varied as we have seen? This experiment strongly indicates how important is the masticatory equipment of man to the development of the head, and it also brings fresh illustrations of the importance of the sadly neglected temporary dentition which serves during the important developmental period of childhood."

There are several other causes of malocclusion which are mentioned but briefly, since their relation to irregularities is well understood.

1. Premature loss of a deciduous tooth or teeth, with resultant contraction of the space occupied in the jaws. Under the discussion of children's dentistry, a suggestion is made for an appliance to retain the space when deciduous teeth, especially cuspids and molars, are unavoidably lost.

2. Pernicious habits, as thumb-, finger- or lip-sucking, use of baby pacifiers and mouth-breathing. Recent discoveries point to habits of position in sleeping as a frequent factor. The pressure exerted against the jaws by pillowing the face on the hand or the arm, and the position of the face in the case of babies who are taught to sleep on the stomach, is believed to have an important relation to the production of malformed jaws. The effect of such habits is particularly detrimental during babyhood or very early childhood, as the bones are soft and respond readily to pressure.

3. The loss of a permanent tooth or teeth. Previous mention has been made of the fact that the loss of a tooth impairs the functioning of five teeth, and this contributes in a large measure to malocclusion. The loss of one or more first permanent molars is especially serious in this connection.

The prevention of malocclusion, as of most diseases, is

chiefly a matter of education. Primarily, the use of natural foods which contain the elements essential to normal growth are a necessity during the prenatal and nursing periods. When the teeth begin to erupt the same natural foods, suitably prepared, still continue to provide building materials as well as to furnish toughness for exercising the muscles of mastication. Secondarily, the prevention of pernicious habits and the preservation of the deciduous and permanent teeth are important measures to insure the normal development of the jaws and the symmetrical arrangement of the teeth.

The dentist, who is in possession of the knowledge of the known means to prevent malocclusion, has daily opportunities to spread enlightenment that will help to eradicate a physical defect which equals dental caries in prevalency.

CALCAREOUS DEPOSITS UPON THE ENAMEL.

Calculus is deposited upon the teeth in much the same manner as the similar concretions, such as gall stones and kidney stones, which are found in other parts of the body. There is invariably a nucleus of some foreign substance or of dead organic or inorganic matter. In the mouth the nucleus may be food débris, precipitated mucin, rough edges of fillings or ill-fitting bridges, etc. When the saliva is stagnate or slow moving about a possible nucleus it undergoes certain chemical changes which diminish its power to hold calcium salts in solution. The calcium is thus precipitated about the nucleus, and the whole bound together by mucin. The mass, as it becomes permanently attached, is colored by various agencies, such as chromogenic bacteria, the hemoglobin of the blood, nicotin, etc.

Salivary calculus is found to be soft when freshly deposited,

and readily removed from the surface to which it has adhered. In from six to twelve hours the hardening process has begun, and after twenty-four hours it is difficult to remove with ordinary brushing. One of the reasons for rigid mouth cleanliness is to be noted here. The hardness of the deposit increases continually until the end of two months, when it is fully hard and cannot be removed except with instruments. Hence one of the reasons for frequent prophylactic treatment for the removal of these deposits.

The general bulk of deposits is found on the teeth near the openings of the salivary glands, but since calculus will not adhere to a flat smooth surface conditions must be favorable for its retention. Roughened enamel surfaces, or any depression on the surfaces of the teeth, are favorable to the deposition of calculus. Conversely, highly polished enamel, smooth contoured fillings and normal gingival line do not readily retain a deposit, and the act of mastication, especially of coarse foods, is sufficient to dislodge it. If salivary calculus is deposited over a long period resulting in large accumulations, a series of pathological conditions arise, including gingivitis, suppuration and pericementitis which frequently results in the loss of the tooth. In addition to this the menace to the general health of the patient with such a mouth must always be considered for calculus by its porousness, absorbs liquified débris and is an ideal breeding place for millions of microörganisms. It is absolutely essential to the general health of the patient, as well as for mouth health, that all such deposits be removed at frequent intervals.

In the average adult mouth calculus is frequently present in sufficient accumulations to be visible, but an important point to be emphasized is that many mouths are seen in which no calculus is visible. In these

Fig. 21

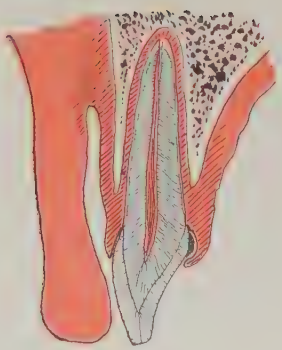


Fig. 22

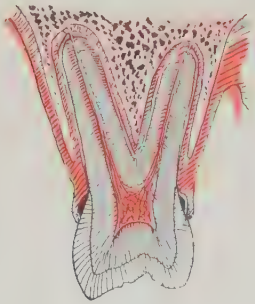


Fig. 23

Figs. 21, 22, 23.—Drawings to illustrate the positions in which calcareous deposits commonly occur on the surface of enamel in the subgingival space. Such deposit is *not visible* but becomes an irritating agent, conducive to the destruction of the investing tissues. (Black.)

mouths the conditions which favor the deposition of calculus above the gingiva are not present, but it is rare that an examination of the subgingival enamel with an explorer will not disclose deposits of subgingival calculus. The deposit frequently takes the form of small distinct scales, or nodules, although in some cases a ring is formed completely around the gingival border. The uninterrupted accumulation of these deposits gives rise to gingivitis and suppuration and frequently destroys the attachment of the pericementum (Figs. 21, 22 and 23).

One of the great efforts of preventive dentistry lies in the systematic and thorough removal of all deposits of calculus before the accumulations can aggravate a condition of pathology. In subsequent chapters the technic of this prophylactic operation will be described in detail, as well as the system of daily home care of the mouth, by which the patient may prevent the accumulation of large deposits in great measure.

Up to the present time no solvent for calculus has been found which is efficient and can be used with any degree of safety to the tissues. The enamel of the teeth is similar in a certain degree to the composition of the calculus, and it becomes a difficult problem to apply a solvent to hardened calcareous deposits without injuring the enamel.

The deposition of calculus upon the teeth is in relation to the composition of the saliva, and is therefore one of the problems of metabolism. No doubt future experiments will provide additional knowledge which is needed to control the deposit through dietary measures, but at present there is little that can be definitely stated in this regard.

The late G. V. Black produced what he termed a paroxysm of deposit of salivary calculus, as the result of certain dietary procedures which, when analyzed, seemed to show an

excess of protein. He proved in several cases that the food habits could be so regulated, in addition to frequent brushing of the teeth, so as to successfully prevent the formation of calculus. However, until further research is made into this interesting phase of the subject, dependence must be placed upon the frequent mechanical removal of calcareous deposits upon the enamel, and the preservation or restoration approximating normal mouth conditions.

INCIPIENT PATHOLOGY OF THE PERIDENTAL TISSUES.

The pathology of the investing tissues of the teeth is frequently overlooked by the average practitioner, and is therefore the most neglected in the routine examination of mouths. However, it is truly stated that more teeth are lost as a result of diseased investing tissues than from dental caries. This will serve to show the great prevalency of infection in these tissues, the majority of which is preventable or curable by comparatively simple measures. A very large percentage of the diseases of the investing tissues is due to exciting or local causes present in the mouth.

At no time is a mental picture of the normal healthy mouth more valuable than during an examination of the average mouth, for prevention is largely dependent upon early recognition of any departure of the tissues from normal, followed by prompt treatment. *It is to such incipient pathological conditions that reference is made, and not to disease in an advanced state, where preventive measures are no longer efficient.*

The exciting causes of diseases, especially of the soft tissues, have one common factor in that they are all irrita-

tive. The irritation may affect only the superficial or gingival tissues, or may extend to the deeper investing tissues.

The most frequent irritation with resulting gingivitis is that produced by uncleanliness and lack of function. An unclean mouth is ideal for the rapid propagation of microorganisms and the toxins produced by the action of these microörganisms on food débris which collects along the gingival borders are exceedingly depressing and irritating.

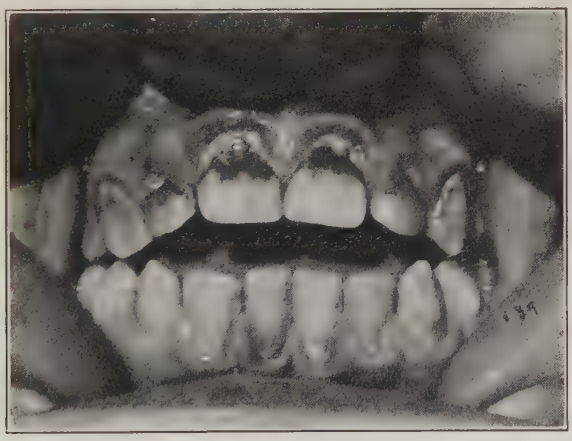


Fig. 24.—An unclean mouth with resultant gingivitis. (Bunting.)

It is impossible for these tissues to retain a high resistance to infection when the mouth is habitually unclean and the teeth do not function correctly, with the result that gingival inflammation, though slight at first, becomes more acute and may eventually involve the deeper tissues (Fig. 24).

The second frequent cause of gingival irritation is that produced by deposits of calculus. If calculus accumulates over a long period a series of pathological conditions arise, beginning with gingivitis which if unchecked eventually

extends to the dental ligament (Fig. 25). When this vulnerable area is reached, and the attachment of the fibers is destroyed, all of the deep investing tissues of the tooth are exposed to the destructive forces of infection which frequently results in the loss of the tooth (Fig. 26).

Fig. 25.—Subgingival calculus, with gingival inflammation and absorption. (Bunting.)

Formation of Pockets.—The pericementum forms the most vital part of the foundational structure of the tooth. Upon its health and resistance depend the function and life of the whole tooth. If it becomes injured, irritated or infected at its border, and the lesion is neglected, the pericementum dies at this point, and in dying causes the death and absorption of a similar area of the alveolar process which was in apposition to the affected tissue. This makes a space or so-called pocket under the margin of the gum where food débris can find lodgment, and where bacteria, well out of the currents of the saliva which flow freely around the teeth can hold a tenable position.

The rapidity of the absorption is dependent upon the resistant force contained within the cells of the pericementum, and upon the virulency of the attacking microörgan-

FIG. 26.—A drawing to show destruction of the gingival tissue by an extensive accumulation of calculus. (Black.)

isms. In childhood this tissue is thick and highly vascular, and can resist almost any invasion of bacteria, if not too seriously wounded. In adult life it gradually becomes thinner, the blood supply is lessened, and, as age advances, the cells lose the high resistant force of youth. If the patient is in poor health from improper diet, unclean environments, harmful habits, excesses, or from any cause that will disturb the proper metabolism of the tissue by disturbing the nutritive or the nervous systems, the resistant force is still further lowered, and the pericementum and other supporting tissues of the tooth become easy prey to the invading bacterial host. Although it will be possible to raise the resistance by proper hygiene and prophylactic treatment and training of the patient in the proper methods of artificial stimulation of blood to the tissues, it can be realized that it is far more desirable to prevent the disturbance and save the patient the treatment necessary to get control of this much dreaded and serious condition of absorption and infection of the supporting tissues of the root of the tooth. *It must always be borne in mind that any irritation of the gingival border, especially in adult life, is a menace to that tooth which is in closest proximity to the point of irritation* (Fig. 27).

A similar succession of symptoms may arise from any constant irritation of the gingivæ, but habitual uncleanliness, especially when large accumulations of calculus are also present, must be regarded as the chief and most dangerous irritation. In all cases the bacterial invasion is secondary to the primary effect produced by the irritative agent, consequently mouth hygiene should be regarded as the most important preventive of diseases of the investing tissues of the teeth.

The other irritative causes may be listed under the head-

ing of imperfect dental operations. Of special importance are all fillings or crowns lacking proper contact points (Fig. 28); rough fillings with overhanging edges, ill-fitting crowns, unsanitary bridge work, or any restorative effort which retains food débris, or impinges on the soft tissues to impair the circulation. When there is an adequate blood supply and the complete removal of waste products the natural resistance of the tissues will combat infection.

FIG. 27.—Advanced pocket formation in bicuspid and molar region induced by accumulation of calculus, and crowding of food in interproximal spaces. (Bunting.)

Reference must here be made of the purely mechanical injuries to the soft tissues produced by careless use of materials or instruments in dental operations. The dentist who is a specialist, trained to prevent and alleviate disease of the dental tissues, should never, by any careless operation or by the materials used in such operations, be responsible for any abuse of these tissues. It is not uncommon, however, that in addition to the examples of imperfect restora-

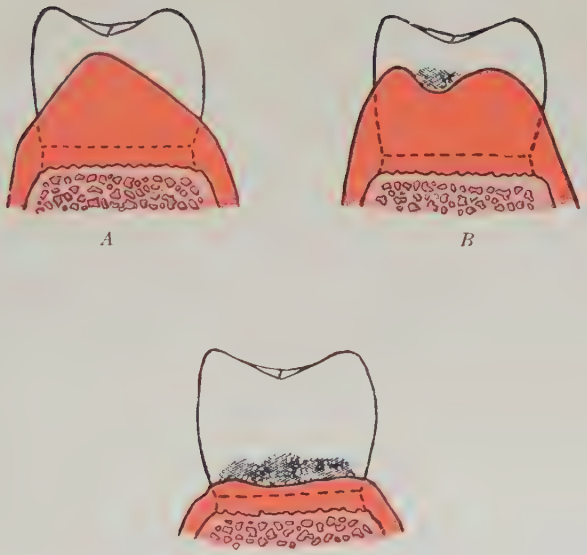


FIG. 28.—*A* represents normal contour of the septum; *B* represents first injury resulting from imperfect contact point; *C* represents almost complete destruction of septum as a result of injury. (Black.)

tions mentioned previously, the soft tissues suffer injuries from the common materials used in the routine of operative dentistry, such as ligatures used in adjusting the rubber dam and drawn down tightly upon the gingival tissues (Figs. 29 and 30), clamps and separators which force the soft tissues out of form, finishing strips and disks which abrade the surfaces of the gingivæ, gutta-percha packed carelessly in approximal cavities and causing pressure

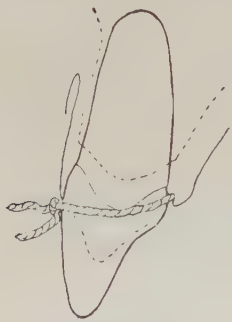


FIG. 29.

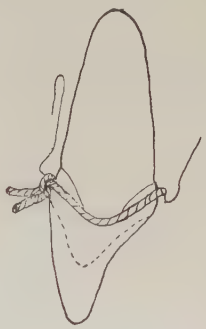


FIG. 30.

FIG. 29.—Diagram showing the correct relation of the ligature to the attachment of the soft tissue on the proximal surface of an incisor. (Black.)

FIG. 30.—When the ligature is drawn tightly against the gingiva, as shown in the drawing, the cutting of the attachment of the soft tissues is inevitable. (Black.)

absorption, etc. A thorough understanding of the histology of the dental tissues upon which he is operating, and a conscientious responsibility toward the patient entrusted to his care should be sufficient to prevent a dentist from any abuse of the soft tissues.

The abnormal occlusal stress to which individual teeth are very frequently subjected during mastication often produces pathological changes in the deep investing tissues, which may result in the breaking-down of these tissues, and

in loosening of the teeth. The occlusal surfaces of the teeth must be ground to relieve the stress and even-up the forces of mastication. This operation should be performed with utmost care.

It can be readily understood what a large part is played by these various local conditions in the inflammation and infection of the peridental tissues, and it may be said that the majority of cases respond promptly to proper local treatment, if not too long delayed. However, the known means of prevention are so efficient and so simple that it is only ignorance of these measures that permits the appalling prevalency of the common diseases of the investing tissues.

The treatment can be summed up under:

1. Removal of irritation.
2. Establishing extreme cleanliness and normal circulation.

CHAPTER III.

THE PRINCIPLES OF DENTAL PROPHYLAXIS.

For many years the concentrated effort in dentistry and medicine has been upon the cure of disease. The medical profession in recent years has made great progress in the eradication of plagues, as smallpox, yellow fever, bubonic plague and others, by discovery of the cause and subsequent elimination of the factors conducive to the propagation of these diseases. These efforts at prevention open a wide field for the elimination of many other diseases, particularly the early recognition of communicable diseases, and the application of those measures which effect a cure in the first stages of illness. Another very important phase of medical preventive effort has been in the discovery of physical defects developing in early childhood, and the early treatment to prevent serious handicaps in adult life.

In dentistry the preventive measures have included the filling of small cavities, and particularly the fissures of molars and bicuspids, the early recognition and treatment of gingivitis, the correction of malocclusion in young children and the removal of diseased teeth for the prevention of systemic infection and the construction of more hygienic and anatomically correct restorations.

These and many similar efforts are exceedingly valuable, and are essential for the control of communicable disease and the elimination of defects already present which threaten the health of the individual. These measures will always

be necessary to follow, and may be termed the *remedial* phase of prophylaxis as distinguished from *true* prevention.

The remedial measures used in the prevention of disease may be likened to the burning of a dry bush on the edge of a forest which, if unchecked at the outset, may result in the destruction of the entire forest. The extinction of the fire in the bush is exceedingly necessary, if the life of the forest is to be preserved, and is analogous to the measures previously mentioned, intended as they are to check the progress of a disease or defect which has already manifested itself.

A more far-reaching effort at forest fire prevention lies in those educational measures which warn the uninformed of the danger of unextinguished fires, and raise the intelligence of the individual by spreading information as to the correct disposal of lighted matches and other inflammable material.

Thus it is that true prevention of disease is, in its broader conception, a matter of education rather than an operative or therapeutic procedure. It is difficult for the medical or dental profession to keep the truly preventive measures in view, confronted as they are by diseases already in progress and by physical defects which are so prevalent as to seem almost inevitable. Yet Nature never intended that man should develop a diseased and defective organism. In the forms of animal life which follow most closely to the laws of Nature, defects and diseases are the exception and not the rule. True prevention can only be practised through those educational measures which make the natural laws of health the common knowledge of all people until, through his own intelligence, the individual is able to follow the hygiene which tends to produce the most normal development of the cells and tends to keep the tissues in a continual state of health and resistance through natural living. The

knowledge of hygiene which has been gained through the past years of careful research must be disseminated through the public schools, for with the children of the race the measures of prevention are most helpful and far-reaching.

The *exciting* cause of many of the pathological conditions of the tissues of the mouth is the combination of micro-organisms and food débris. Bacteria alone, or food débris alone, would be quite harmless in the mouth. Nearly all germ life, in order to become virulent or its presence dangerous or even objectionable, must have a pabulum upon which to thrive. It is therefore dependent upon some attractive food supply in order to reproduce and multiply.

For years many efforts have been made to find some drug or chemical that could be used in the mouth to kill all bacteria, or at least to render them inert. The futility of even hoping for a sterile condition of the mouth has long since been demonstrated. It is impossible to sterilize the human mouth, and even if it were possible such a condition could be maintained but a very short time. Therefore, if it is impossible to keep the mouth free from bacterial life, and as the combination of food débris and bacteria is a cause of dental disease, is there not some way in which the food débris can be thoroughly removed? It is upon this thought that certain principles of prophylaxis are based.

Dental prophylaxis is that scientific effort, either operative or therapeutic, which tends to prevent diseases of the teeth and their surrounding tissues. Correcting and restoring to normal function all abnormal or pathological conditions of the teeth, and maintaining that normal condition is a prophylactic procedure. This includes practically all the operations in dentistry. The mere filling of a tooth cannot be termed prophylactic unless the operation is performed with a knowledge and skill that tends to prevent future decay at

that point, and that will restore the surface of the tooth to normal contour and normal function. Crowns and bridges, and root-fillings, approximal fillings, with proper contact points and smooth flush margins, and the correction of malocclusion may all be made prophylactic if properly done.

The term "prophylactic treatment" is generally used to designate the removal of all calcareous deposits, the polishing of all surfaces of the teeth and the instruction of the patient in the home care of the mouth. The object of these operations is to prevent dental caries and diseases of the investing tissues of the teeth through cleanliness.

The detail of restorative operations from the prophylactic aspect will be covered by the course in operative and prosthetic dentistry, and the intent of this text is to mention but briefly some of the major phases in hygienic restorations. A technic for the prophylactic treatment of the mouths of children and adults will be described in detail.

DENTAL PROPHYLAXIS FOR CHILDREN.

It has been shown in the discussion of diet that the prenatal and early childhood periods are of the greatest importance to the formation of good teeth. If the food supply of the prospective mother has been normal and adequate during that period the next requisite is that the infant be breast-fed, for there can be no greater insurance for health. In the event that the infant cannot be nursed, the utmost effort should be made to adapt modified cows' milk to its use, as the majority of prepared, commercial baby foods are deficient in the essential mineral elements. An infant fed on condensed milk, or many of the prepared baby foods has started life with the nutritional handicap that can never be wholly overcome.

If one considers that from birth to five years of age the body structure of a child is tripled in length, and fifty-two teeth are in various stages of development, it is immediately apparent that at no other period is an adequate food supply more necessary, especially the mineral elements so essential to the development of bones and teeth. Therefore, *the success of dental prophylaxis with children is largely dependent upon a normal food supply during infancy and early childhood.*

Care of Infant's Mouth.—It is the duty of the dentist to inform mothers of the proper procedure for cleansing an infant's mouth. If this hygienic procedure is neglected it destroys, in a measure, the effect of the care that is usually exercised to give the infant clean milk in sterile bottles. It is equally important in breast-fed infants, for both mothers' milk and cows' milk will readily ferment in such an ideal incubator as the mouth. Although most people realize that fresh milk placed in a bottle that has contained sour milk will immediately become infected, they do not know that after feeding a film of milk is left in the mouth which sours and acts in the same manner on the fresh milk at the next feeding. This condition is frequently the cause of colic and infant stomatitis.

An infant's mouth may be effectively cleaned as follows: Wash the hands and wrap the end of the index finger with antiseptic cotton to make a small swab. Saturate the cotton with boiled water, and swab all parts of the mucous membrane to mechanically cleanse it. The benefit to the infant's digestion, as well as its mouth health, makes it exceedingly important to repeat this procedure *before* as well as after each feeding, for frequently milk is regurgitated in the period between feedings.

This method of cleansing the mucous membrane is applied

to the teeth also as they erupt, and is sufficient until the age of one year. After this time a small soft brush should be used. The thoroughness with which this cleansing can be accomplished depends upon the attitude of the child and the skilfulness of the mother or nurse. If the child objects to the brush so that the cleaning is not efficient, the swab should be continued in conjunction with the brush. Children like to imitate an adult, and as soon as a child shows this tendency he should be encouraged to manipulate his own brush while watching an adult or older child. When all the deciduous teeth are in place a dental floss should be passed between the teeth at bedtime to remove food particles from the approximal surfaces. Especial attention should be given to brushing the occlusal surfaces of the molars.

Prevention of Bad Habits.—In babyhood and early childhood the bones are soft, and respond readily to pressure. Malocclusion produced by pressure against the jaw bones can be obviated, to a great degree, by the prevention of pernicious habits which develop in infancy.

The use of various types of baby pacifiers should be condemned at all times, and frequently a dentist may suggest methods to break the habit of thumb- or finger-sucking. Any method which successfully prevents the child from getting the hand to the mouth will be effective, such as: (1) Pasteboard mailing tubes placed over the elbows and fastened to the sleeve to keep the arm straight; (2) if the child wears a sleeping garment that fits over the legs, tapes attached to the sleeve and the side of the garment will prevent raising the arm to the mouth; (3) aluminum mittens, which can be purchased at any department store, are found successful in many cases, and frequently a child will not suck a woolen or cotton mitten.

When an infant is well nourished it is not liable to develop

these habits, especially if a hard rubber ring is supplied, to bite on during the teething period.

Long sustained pressure against the face when pillowed on the arm or hand, or a hard mattress during sleep, is regarded as a cause of malocclusion. A baby should sleep on the side and resting partly on the stomach, with a soft pillow of sufficient thickness to sustain the head in a level position with the shoulders bearing the weight of the body.

When the deciduous teeth are erupted a child should be encouraged to masticate the hard crusts of bread to assist in the development of the jaws.

The age at which a child should report to the dentist for an examination of the teeth has been much discussed. It may be said that ideally the age is two and a half to three years. At this age the deciduous teeth are fully erupted, the child is eating practically all the common foods and the need for mouth hygiene is apparent. This is considered an early age, but statistics of the mouth conditions of children entering public schools at five years of age show that prophylactic measures to prevent dental caries of the deciduous teeth are then about two years late. It is not usual to find a clean healthy mouth with sound deciduous teeth in children at five years of age, who have lacked dental supervision.

Preservation of Deciduous Teeth.--It seems unnecessary to state but briefly the immense importance of preserving the deciduous teeth in a state of health until they are normally shed. There is no doubt but that their influence on the development of the growing body is more vital than the proper functioning of the permanent teeth in adult life. The dentist has failed to appreciate their importance in many cases where the parent sought to have them cared for, but the common excuse of "its only a baby tooth, why

waste time and money on it?" shows an appalling ignorance of the following facts:

1. The first step in the proper nutrition of the child is performed by a sound set of deciduous teeth.

2. The development of the jaws depends upon normal nutrition and the function of mastication.

3. Each deciduous tooth retains the space for the permanent tooth, and guides it into place, and its premature loss may result in malocclusion.

It is a common procedure to refuse to fill the cavities in deciduous teeth, but to allow the various teeth to remain in the mouth to "retain the space." Such procedure shows an even more appalling ignorance of the bodily illness that may result. The food débris in open cavities becomes the ideal breeding ground for millions of bacteria, with the result that the products of decomposition are constantly swept into the intestinal tract. The eventual death of the pulp permits of the possibility of ingress of the bacteria into the blood stream. The result is fever, headache, eye disorders, malnutrition and a host of other mental and physical disturbances. From the humanitarian standpoint alone, the dentist should realize that a toothache is a toothache whether it occurs in a deciduous or a permanent tooth, and only the most heartless would refuse to make an effort to prevent this unnecessary pain and suffering of a child. The lack of interest in the health of a child's mouth shows a failure to grasp that the health and comfort of its body are dependent upon sound deciduous teeth.

Further, the most fruitful field for prevention is in the child mouth. Every dentist should perfect himself in the technic of prophylaxis for children, regardless of whether he intends to perform this service himself, or refer it to the dental hygienist.

The Prophylactic Treatment.—The removal of stains and plaques from young children's teeth can be accomplished by the orange-wood sticks and pumice, it seldom being necessary to use instruments. The procedure may be outlined as follows:

A cursory examination is made of the mouth. The teeth frequently present what is known as green or brown stain, produced, apparently, from two causes—in unclean mouths the gum margins are frequently irritated and weeping, a little of the coloring matter, or hemoglobin, of the blood seeps out and is attacked by mouth bacteria. The sulphide compounds in the resulting putrefaction combine with the hemoglobin to produce a greenish or brownish stain at the gingival borders of the teeth. The stain is, therefore, a product of decomposition found in neglected mouths. A similar stain is due to the pigmentation of Nasmyth's membrane by certain chromogenic bacteria.

The removal of these stains, as well as the bacterial plaques, is assisted by the application of Churchill's compound tincture of iodin. The iodin assists chemically in the removal of stains and plaques, acting also as a disclosing solution for plaques and as an antiseptic and bleaching agent. Three or four teeth are dried with a napkin, and the iodin is applied and allowed to dry. The teeth may then be rinsed, and the polishing process begun, as subsequently outlined under *Polishing* (p. 137). When the teeth have been polished with both the large and small sticks the contact points and the approximal surfaces are cleaned by means of wide, flat dental floss. It is rubbed back and forth against each tooth until the surface is well polished.

The masticating surfaces are so irregular that it is necessary to use a brush wheel in the engine. The brush should

be touched lightly to the masticating surface at first, and then applied to the grooves. A cheek distender should always be used. The mouth may then be sprayed with some pleasant mouth wash in a compressed air atomizer to remove any pumice. Finally the teeth should be examined for cavities with the aid of the mouth mirror and delicate explorers.

The entire prophylactic treatment for children ordinarily consumes but thirty minutes, the operation is pleasant, and children are interested in the procedure, especially if given a small hand-mirror and allowed to watch. The operator has half an hour of the undivided attention of the child and frequently the parent, and this educational opportunity is invaluable to secure coöperation in matters of diet and the home care of the mouth, from both child and parent.

At the first treatment a brush of the correct size and shape should be supplied by the dentist, and the child instructed in the home care of his mouth if he is old enough; otherwise the mother should receive the instruction.

Before the first permanent molars have erupted the following daily care of the child's mouth should be an established habit: Mouth-brushing, which includes both teeth and gums, with clear water upon rising, and with a dentifrice after each meal. The use of dental floss after meals is ideal, but with most patients seems practical only before bedtime, followed with lime-water mouth wash.

Chart Examination of the Mouth.—Unless the child has been sent for treatment at an early age, the chart examination of the mouth will probably disclose the need for operative work. In a child's mouth the following points should be noted:

1. General condition of gum tissue and presence of fistulæ.

2. Condition of enamel surfaces with regard to pits, fissures, and caries.
3. Occlusion.

1. The gum tissue will be a light pink if the gum circulation is normal. If congested the condition can be remedied by proper mouth-brushing. If fistulæ are present they are commonly the result of an abscessed deciduous molar, as these teeth are most susceptible to decay, although cases are frequently seen in which the upper deciduous centrals are abscessed. When the pulp has become involved in any deciduous tooth it is seldom that an attempt at root treatment is advisable or successful. The roots of deciduous teeth are long and narrow, making a perfect root operation difficult. The apices are generally wide, which condition may expose the permanent tooth to injury from the products of pulp decomposition. It is doubtful whether abscessed or devitalized deciduous teeth can be placed in a satisfactory condition, and it seems unwise to retain a tooth that may prove to be a menace to the child's health. Generally speaking, abscessed or devitalized deciduous teeth should be removed. In the event of such an unfortunate condition, the space occupied by the tooth should be retained by a simple appliance until the permanent tooth is ready to erupt (Fig. 31).

A roentgenogram can be used to advantage to locate the position of the permanent tooth, which frequently will erupt in such a short time that a space retainer is unnecessary. The use of roentgenograms in connection with children's dentistry is a most valuable adjunct, and may save needless time and expense in an attempt to restore the crowns of badly decayed teeth when the permanent successors are about ready to erupt.

2. Defects of the enamel surface can frequently be ground

out with a small stone, and polished unless they are deep, in which case the pit should be dried and filled with cement to prevent the retention of food particles. Where caries has penetrated the enamel of deciduous teeth the treatment is the same as for caries in permanent teeth. This is especially true of caries in the molars. Whenever possible the teeth should be isolated with a rubber dam and the cavities carefully prepared. They should be sterilized with nitrate of silver, lined with cement and permanently filled with amalgam.

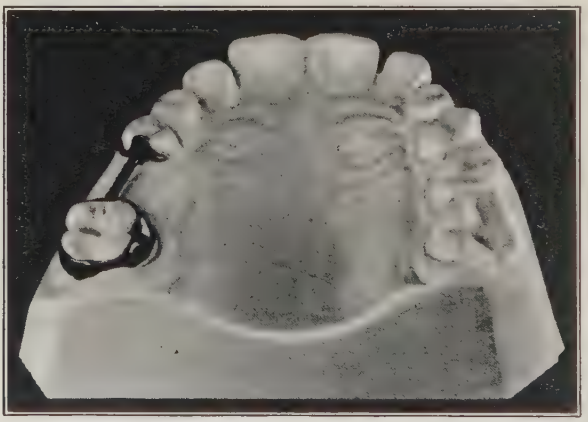


FIG. 31.—Appliance retaining space after premature loss of second deciduous molar. Dental floss can be passed under the half clasp to cleanse the small surface in contact with the anterior tooth.

Special Silver Nitrate Preparation.—In reference to silver nitrate, the author has for many years used a special preparation which has proved very efficient for sterilization and is non-irritating to the pulp. The preparation is made by placing about 2 drops of a 1 per cent nitric acid solution on a glass slab and adding a small quantity of finely ground Standard alloy. This is covered with an equal amount of

Williams' powdered silver nitrate and mixed with a small cotton swab wound on the end of a stiff broach. The mixture should be the consistency of thin cream, and the swab is used to apply it to the pulpal wall of practically all cavities in posterior teeth. It should be allowed to dry, and the surface wiped thoroughly with a dry cotton pledget before the cement lining is applied. When caries occurs on the approximal surfaces attention should be given to maintaining proper contact.

The practice of "plugging up holes with gutta-percha" is much to be deplored, and it is only in the rare cases when a child is either unmanageable or ill that temporary measures are indicated.

When a large part of the tooth structure has been lost through caries, or when for any reason it is not possible to make adequate retention for amalgam, the following procedure has proven practical. Mix a fairly soft amalgam and add to a medium mix of oxyphosphate of copper or zinc cement. Thoroughly spatulate the amalgam with the cement, and insert in the cavity, which should be as dry as possible. The mixture sets slowly enough to be contoured. This combination possesses, to some degree, the adhesiveness of cement and the hardness of amalgam, and will frequently last for a long period.

The roentgenogram will sometimes show that one or more of the bicuspids are missing, in which case the deciduous molar may be retained and give good service for several years. This is only one example of the wisdom of performing painstaking and permanent operations on deciduous molars whenever possible. If the anterior teeth are decayed an oxyphosphate of zinc cement filling is usually indicated, or hard white gutta-percha.

3. *Occlusion.*—In examining the child denture at three or four years of age we should normally find the twenty deciduous teeth arranged symmetrically in the arches and completely filling them. If the normal conditions exist it will be found that the mesio-buccal cusp of the upper second deciduous molar occludes between the mesio-buccal and buccal cusps of the lower second deciduous molar. These may generally serve as guides to the occlusion prior to the eruption of the first permanent molars. If the mesio-distal relation of the jaws and arches is normal, and there is no malposition of individual teeth, the occlusion is considered normal. About four and a half years of age the enlargement of the arches should begin, to provide space for the twenty larger permanent teeth which are to succeed the deciduous teeth. These growth spaces should be well defined before the first permanent molars erupt. If it is evident that proper growth of the jaws is not taking place the diet and habits of the child should be carefully considered in an effort to determine the causative factors.

Treatment of First Permanent Molars. Under ideal conditions a child should be under the care of a dentist before the eruption of the first permanent molars, in which case these teeth can be carefully supervised. The importance of these molars, in that they are the key to the arrangement of other permanent teeth in the arch and must bear the burden of mastication while the deciduous teeth are being shed, makes it most essential that they should be safeguarded against caries and malposition. When conditions are normal, that is, the enamel is dense, the teeth well formed and the grooves shallow, cleanliness is the only measure necessary. From clinical experience it is known that the great majority of first permanent molars are not well calcified and that the occlusal surfaces, as well as the buccal,

present fissures and pits—defects which are soon affected by caries. Nearly all of these defects will eventually develop into cavities, so that when a fine explorer will detect a yielding surface in the bottom of the fissure or pit the whole defect should be cut out for filling. Except in very shallow fissures, the silver-nitrate preparation is used to sterilize the dentin, followed by a lining of cement, and the cavity is filled with amalgam. After many years' experience with various filling materials used for the first permanent molars of young children, the author uses amalgam in the majority of cases for the following reasons:

1. It permits of conservation of tooth structure.
2. It can be inserted with facility and contoured.
3. It is durable for many years.
4. It is simple to remove if in later years the use of gold is indicated.

As a measure in pulp conservation it is not advisable to use silicate cements in the approximal cavities occurring in the permanent incisors of children, because of the possible irritative effect. It is good practice to use hard white gutta-percha which is durable until it is advisable to insert a permanent filling.

THE EXAMINATIONS OF ADULT MOUTHS.

One of the most necessary operations of dentistry, and a most important service to the patient, may be considered under the general heading of examination of the mouth. Many dentists have failed to acquire the ability to make a thorough examination of the mouth, and often do not consider it truly a dental operation, as evidenced by frequent advertisements of "examination free." A painstaking examination, properly done, ranks in importance to the

careful diagnosis of the high-grade physician, who records all general conditions of his patients and bases his deductions and treatment accordingly. The dentist who neglects to record all abnormal mouth conditions, and plans his operations accordingly, has failed in his first service to the patient.

It is the purpose to outline the ideal procedure to be adopted with the new adult patient—ideal in that it affords the maximum service to the adult who presents himself to have his mouth put in order.

Since the advent of the roentgen-ray, with its many startling disclosures of mouth conditions that had never been dreamed of by the dental profession, it may be definitely stated that no dentist can practice his profession intelligently or scientifically without the aid of the roentgen-ray, and as a general rule a roentgenographical examination of every adult mouth should be insisted upon before any other operative procedure.

The handling of adult patients may be listed as follows: (1) The cursory, visual examination of the mouth and preliminary consultation with the patient; (2) the roentgenographing of the entire mouth, usually requiring ten regular sized films; (3) the instrumentation and polishing of the exposed surfaces of the teeth, followed by instructions in the care of the mouth; (4) a thorough examination of the mouth, recording upon a chart all abnormal conditions revealed visually and by the roentgenograms. At least a half hour is required for this examination.

Divisions 1 and 2 are self-explanatory, and Division 3 will subsequently be explained in detail. There is abundant evidence to show how inadequate a visual examination of the mouth may be, but it still seems essential to stress the necessity of having roentgenograms of each case. In

preventive dentistry for adults there is no more important service than that which is based upon treating the incipient pathology which the roentgenograms of practically every mouth will disclose. The majority of abnormal conditions present in the mouth are difficult to locate with instruments, and in fact the most serious departures from the normal are not discoverable by the ordinary visual methods of examination. Therefore, the roentgenographical examination should not be considered a luxury for, as a rule, it represents economy in time and money to both the patient and operator, and is a valuable assistance in establishing and maintaining mouth health in adults.

The ability to make a thorough mouth examination, visual and roentgenographical, is chiefly a matter of recognizing the beginning of disease or departures from the normal, and is, therefore, an important step in prevention. A systematic examination, permanently recorded, is invaluable to the operator and to the patient.

If the mouth has been roentgen-rayed a careful survey of the roentgenograms should be made previous to the mouth examination, and all abnormal conditions should be recorded upon a chart to be used later in addition to the mouth chart. Some of the conditions to be charted from roentgenograms are:

Group I.—Those abnormal or diseased conditions not visible, or not apparent from the use of explorers.

1. Devitalized teeth: Note root filling—good or poor; note condition of apical area—normal or abnormal, as root resorption, granuloma, cyst, abnormal lamina dura.

2. Suspected devital teeth—no root filling, but apparent apical disturbance, possibly caused by pulp dying under large filling, gold crown or from traumatic causes.

3. Unerupted teeth or impacted teeth: Note evidence of pressure.

4. Supernumerary teeth.

5. Broken pieces of root.

6. Stress: Note causes.

7. Pulp stones.

Group II.—Those abnormal or diseased conditions not visible, but possibly apparent to an explorer.

1. Dental caries on proximal surfaces or under gingival margins of fillings or crowns. Next to the prevention of caries, the discovery of beginning caries is the most vital service toward pulp conservation, and the aid of the roentgenograms in this connection alone justifies their use as a routine procedure in mouth examination.

2. Imperfect restorative operations, as overhanging or rough margins of fillings, lack of contact points, poorly contoured restorations, ill-fitting bands and crowns. The proper operative procedures to remedy these conditions are a part of prevention service to conserve the supporting structures of the teeth.

3. Absorption of alveolar processes: Note causes and depth of absorption. In addition to the conditions listed above, all of which are conducive to alveolar absorption, stress, calcareous deposits and acute inflammatory processes are factors to note.

The charting of the above conditions should be done with roentgenograms mounted with proper illumination and viewed through a magnifying glass. Such a chart enables the operator to approach the visual examination of the mouth most intelligently.

The equipment for a routine examination should include mouth mirror, pliers, cotton pellets, several fine explorers

and frequently floss silk, polishing strips, mechanical separator and mouth light.

The general condition of the teeth should first be noted. The enamel surfaces are frequently without luster, and are covered with a pasty colorless film. The necks of the teeth may be stained or covered with calcareous deposits. The occlusion should be noted and recorded, as well as general cleanliness of the mouth. The gum tissue should be examined and the condition of good circulation or congestion noted. With the forefinger the gums are pressed toward the gingivæ to discover any exudation of pus.

A definite system should be followed in an examination, such as beginning with the right upper molars and covering all tooth surfaces on the upper jaw, proceeding to the lower left molars and finishing with the lower right molars. All conditions should be recorded as the examination proceeds. The conditions to be noted are as follows:

1. General cleanliness of the mouth.
2. Gum condition.
3. Fistulæ.
4. Occlusion.
5. Missing teeth (plans for restoration).
6. Caries.
7. Condition of dental work present, as crowns or bridges, leaking or rough fillings.
8. Contact points.

CHAPTER IV.

THE PROPHYLACTIC TREATMENT.

Before operating in the mouth it should be ascertained that the patient has presented the surfaces of the teeth as clean from food débris, as it is possible to do with the tooth-brush, floss silk and mouth-wash. In the past years dentists have consented without remonstrance to operate under the most unsanitary conditions upon teeth from which no effort has been made to remove the food, and patients have not been made to realize the offensiveness of presenting such a mouth for treatment, consequently kindness and consideration should be used in the handling of such cases. Aside from the sanitary aspect of operating in a mouth free from food débris, the dentist, for his own respect and the dignity of his calling, should make it an absolute rule never to begin an operation for a patient who has neglected to cleanse the mouth. It will require some diplomacy to suggest to a new patient that the mouth must be cleaned before any work can be undertaken, and the explanation should be made that there is danger of infecting the gum tissue if the instruments are used around the gingival borders where decomposing food is present, and that to obviate any such danger it will be necessary for him to thoroughly cleanse his mouth.

A stock of tooth-brushes should be part of the equipment of every dental office, and should be charged up against the expense of dental supplies. The cost of the brushes, if bought in quantities, amounts to but little when we consider

their absolute necessity for instruction of the patient in the home care of the mouth, and their use when needed under these conditions.

Patients soon learn the rules of an office, and in a comparatively short time it will be a rare thing to be obliged to send a patient to the bowl to brush his teeth before the prophylactic treatment can be started. Much of the soreness of the gums after these treatments in the mouths of new patients is due to crowding some of this infected material under the gum margin with the instrument, and

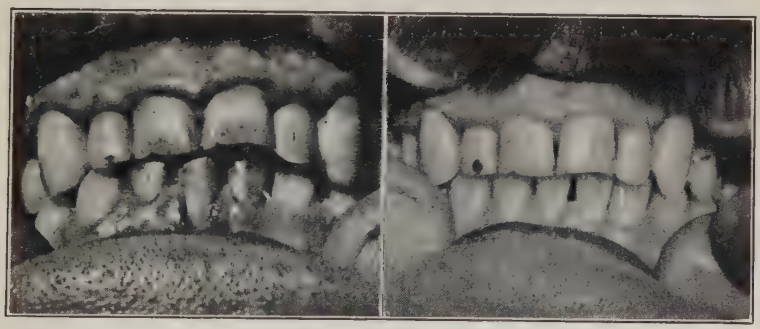


FIG. 32.—A neglected mouth before and after the prophylactic treatment. (Bunting.)

it follows that the cleaner the necks of the teeth are before instrumentation, the quicker will be the recovery of the congested gums after treatment.

In considering the practical work of dental prophylaxis, the operation in the mouth of the adult will be first described. With a pledget of cotton soaked with peroxide of hydrogen, the necks of the teeth and also the approximal surfaces should be bathed. Aside from the germicidal action, the boiling of the peroxide will mechanically aid in loosening minute particles of food débris. After rinsing the mouth

with warm water the teeth should be thoroughly sprayed on all their surfaces with a compressed-air atomizer containing any harmless and pleasant tasting wash. The air-pressure should be at least 25 pounds, so that it may have enough force to blow the spray between the teeth to aid in this mechanical cleansing.

The following procedure in instrumentation is designed especially for a preventative treatment of the teeth and gums, and is the prophylactic operation which dental hygienists are permitted by law to perform. It, therefore, does not cover the treatment of any diseased condition. With an understanding of the etiology of diseases of the peridental tissues it can be readily recognized that these diseases are, for the most part, preventable and that the most definite and effective preventive treatment is this comparatively simple one of instrumentation and polishing, augmented by the correct cleaning of the mouth at home each day. Whether the dentist intends to carry out the treatment himself, or delegate it to a dental hygienist, it is essential that he should thoroughly master the technic of this operation, in order to skilfully perform the more difficult surgical instrumentation that is found necessary in diseased conditions of the peridental tissues.

Surfaces of the Teeth.—The treatment is designed to remove all deposits, stains and secretions from the exposed surfaces of the teeth and the areas directly beneath the free margins of the gums.

The base of the crown of each tooth has four lines. This is the entire field for the use of the instruments unless a root surface is exposed. It can be readily appreciated what a slow and painstaking piece of work it is to go over carefully each of these surfaces and remove all of the deposits of tartar. However, it is absolutely essential for the health

of the gums and the roots of the teeth that all calculus be removed at frequent periods. The time may come when people may be induced to eat the proper foods in proper quantities, then this deposit will be greatly lessened, but until this goal of good sense is gradually reached, artificial care of the mouth by prophylactic treatments will have to be resorted to.

Much of the irritation resulting from the formation of calcareous deposits in the subgingival space can be obviated by eliminating the congested condition of the capillary circulation found in the gum tissue in the mouth of the average adult. But the mouths are indeed rare in which no new deposits can be found under the gingival borders after a period of two months.

System for Instrumentation.—In order to perform a prophylactic operation intelligently one must work by system, and the instrumentation as well as the polishing must have a definite starting-point in the mouth and should always proceed in the same given direction over the surfaces of the teeth in the case of every patient. This is necessary for thoroughness, and also in case of interruption, for if one will but note mentally the last tooth being worked upon before leaving the chair the chain will remain unbroken upon resuming. It matters little what system is finally adopted, but the one here suggested is advocated because it has proven very practical.

Lower Jaw.—Beginning on the lingual surface of the right lower last molar at the gingival line, disto-lingual angle, instrumentation proceeds mesially until the lingual border of the left lower central is reached. The same direction is now followed but the line of operation becomes distal on the left side, still keeping on the lingual surface until the disto-lingual angle of the left lower last molar is reached.

Again starting on the disto-buccal angle of the left lower last molar, the instrumentation proceeds buccally and mesially until the left lateral is reached, where from this point the operation continues on the same surface to the disto-buccal angle of the right lower last molar.

The following cuts are taken from Plate VI of the *American System of Dentistry*, and will, by the dotted lines and arrows,

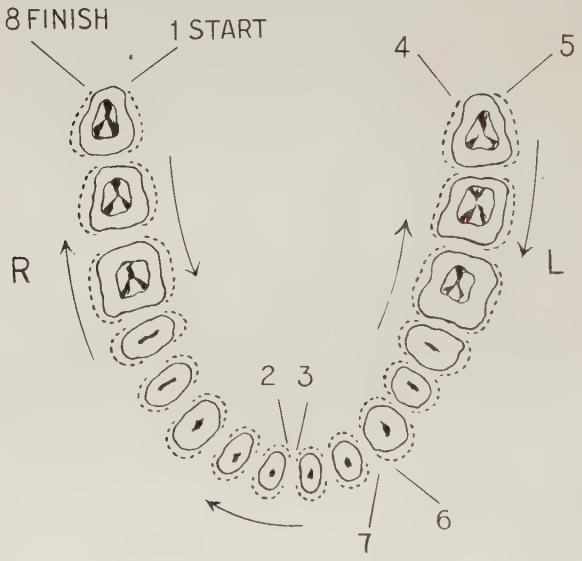


Fig. 33.

better illustrate the directions followed as just described. Fig. 33 represents the teeth of the lower jaw with crowns excised at the gingival border. These cuts will illustrate the lines to be followed and field of operation to be covered with the instruments.

As shown by the dotted lines in Fig. 33, this first use of the instruments on the lower teeth covers only the lingual

and buccal surfaces. By working along on the same surfaces of the teeth on the same jaw, considerable time may be saved by not having to change instruments every moment or two, as one instrument frequently will adapt itself to eight teeth before it will be found necessary to change.

After the deposits have been removed from the lingual and buccal surfaces attention is given to the distal surfaces. Once more, beginning on the distal surface of the right lower third molar, the distal surface of the right lower molars,

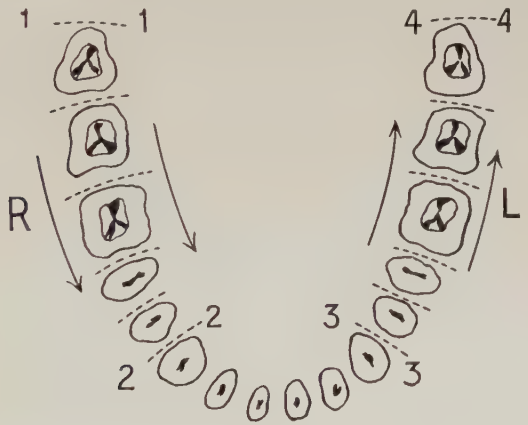


FIG. 34.

bicuspids and cuspid are carefully scraped. Next the distal surfaces of the left lower cuspid, bicuspids and molars, as illustrated in Fig. 34. One instrument will usually adapt itself to these surfaces. Next the mesial surfaces of the right lower molars, bicuspids and cuspid, then the mesial surfaces of the left lower cuspid, bicuspids and molars. These surfaces, too, may usually be covered with one instrument. Lastly, the approximal surfaces of the lower incisors, which may be covered with two instruments (Fig. 35).

Upper Jaw.—On the upper jaw at the point of corresponding with that where work was first started on the lower jaw, the disto-lingual angle of the right upper third molar, the lingual surfaces of the superior set are cleaned of all calcareous deposits, working mesially until the left central is reached, then distally to the left third molar. Again starting at the disto-buccal angle of the left upper third molar the buccal surfaces are gone over, working mesially to the right central then distally to the right third molar

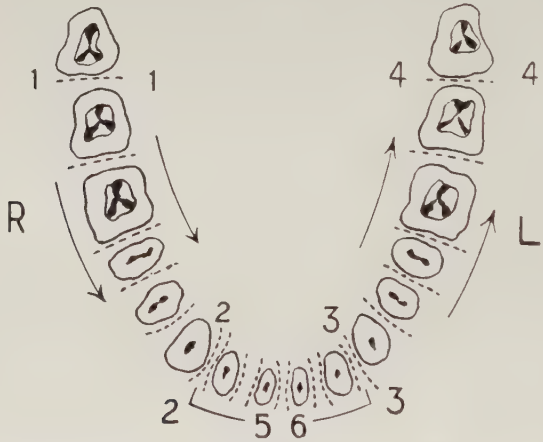


Fig. 35.

(Fig. 36). Now, beginning at the right third molar, the distal surfaces of the right molars, bicuspids and cuspids are scraped. Next the distal surfaces of the left cuspid, bicuspids and molars (Fig. 37). In the same order the mesial surfaces are gone over, leaving the approximal surfaces of laterals and centrals until the last (Fig. 38).

If this briefly outlined system is followed there will be but little chance that the deposits may escape the play of the instruments.

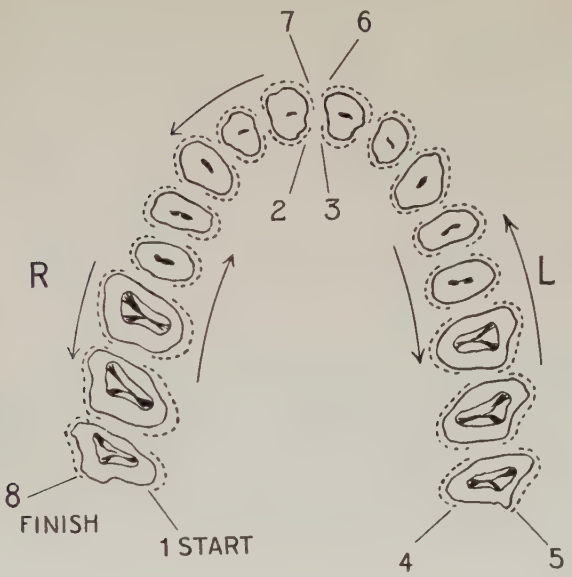


FIG. 36.

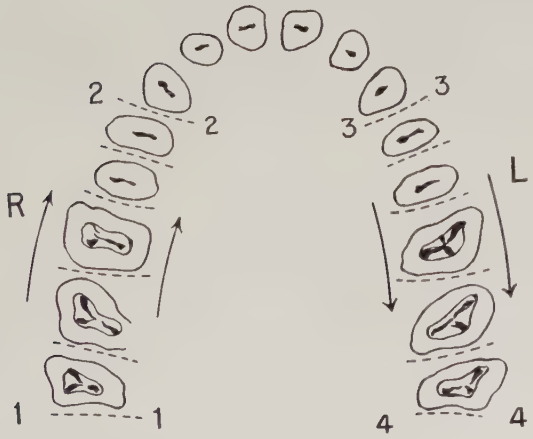


FIG. 37.

There is nothing that instills a greater confidence in the operator, in the mind of the patient, than the gentle touch of his hand and the instruments. The very first requisite is to try to develop a firm yet gentle touch. In handling the lips, the cheek, the tongue, the motions should be slow enough and deliberate enough to insure gentleness. Such precautions in self-training soon improve the technic in handling the instruments, and it is much the better fault

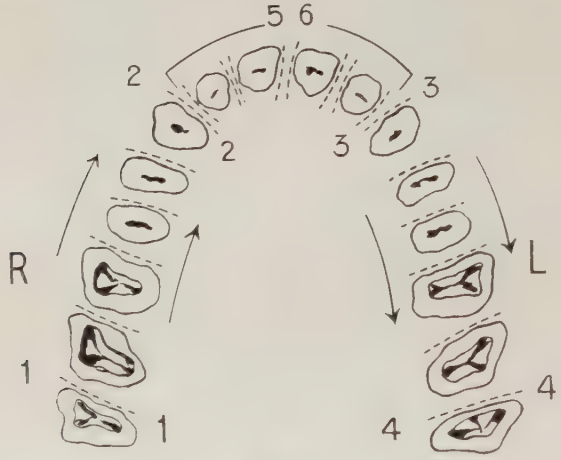


Fig. 38.

to be overgentle and a little less thorough to begin with than to be heavy-handed, rough and overstrenuous with the instruments. There is no better application of the golden rule than in dentistry, and the operator who masters a fine sense of touch and constantly keeps in mind a sympathetic consideration for his patient has conquered much that is productive of success.

The mouth mirror is essential in operating on the lingual surfaces of the upper teeth, and can also be used to advan-

tage in holding the tongue away from the lingual surface of the lower teeth.

As the motion reflected in the mirror is reversed from that of direct observation, it is puzzling at first to place the instrument properly, but a little practice will soon obviate the difficulty. The Dunn cheek distender is used to expose the buccal surfaces of the teeth, both in instrumentation and polishing, and its use adds much to ease of vision and access to these surfaces.

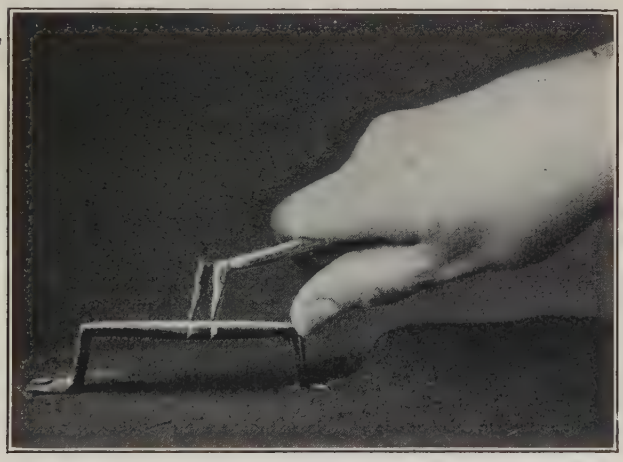


FIG. 39.

The Four Motions.—In instrumentation, as well as in polishing, there are four distinct motions. These may be termed digital, wrist, rotary or forearm and rigid arm. In acquiring these movements the fulcrum point of the hand in relation to the hold of the instrument is the determining factor. If the digital motion is to be used the instrument or polisher is grasped as illustrated in Fig. 39. The end of the right thumb is the fulcrum-point or rest. This position

permits of a perfect control of the instrument and allows a play of the instrument in either a push or a pull stroke. This motion is used particularly on the teeth of the upper jaw. It might be well to state here that no instrument should be used in the mouth unless the hand is first braced by a suitable rest for one or more of the fingers of the hand holding the instrument. No free-hand motion should be

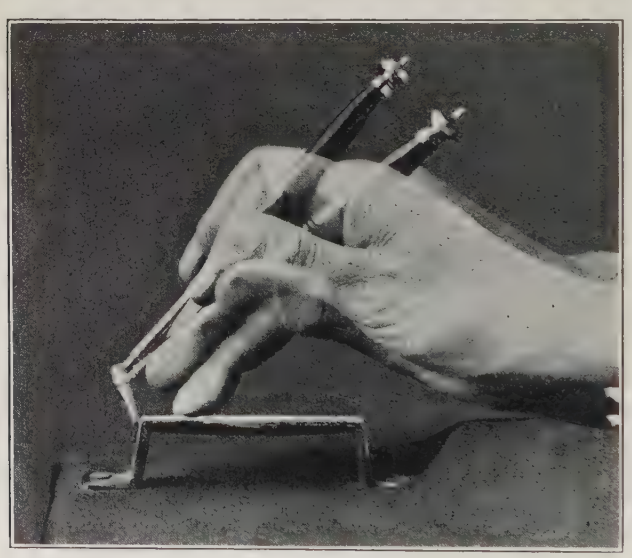


Fig. 40.

used. Such motions would be almost sure to invite a slip of the instrument and result in laceration of the gum tissue. The wrist motion is acquired by holding the instrument as illustrated in Fig. 40, using the end of the second or third fingers as a fulcrum. This motion may be used in various parts of the mouth, especially on the lingual surfaces of the molars and bicuspids, but it is not as effective for general

use as the forearm or rotary movements. The forearm or rotary motion is used on both the upper and lower jaws, and usually the end of the third finger serves as a fulcrum, although that of the second finger can sometimes be used. This motion is produced by holding the muscles quite rigid, permitting the radius to rotate around the ulna bone in a limited area. After a little practice this motion permits of a rapidity of work with the instrument under perfect con-

FIG. 41.

trol, and to master this stroke is to master much of the technic of instrumentation and polishing.

Fig. 41 illustrates the position of hand when using the rotary motion.

The rigid-arm motion is used for polishing nearly all of the labial and buccal surfaces of the teeth, both upper and lower, and for the lingual surfaces of the molars and bicuspids. The rest is usually found by using the side of the second

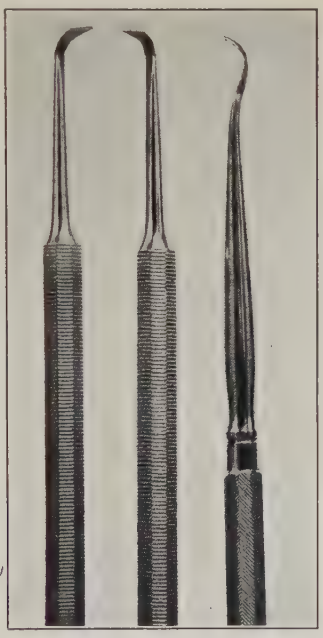
joint of the right thumb on the chin or the second joint of the third or fourth finger, as illustrated in Fig. 42.

The muscles of the whole arm are made fairly tense, and the arm is made to travel forward and backward in a short limited area. All of these motions should be practised over and over again on manikins before being tried in the mouth. They are not easy to master and the muscles must be trained by repeated practice.

Fig. 42.

In the removal of tartar around the necks of the teeth there are two strokes that may be utilized—a push stroke and a pull stroke. Which to use is determined in a great measure upon the quantity or bulk of the deposit and also upon the tenacity with which it may cling to the tooth surface. In scaling off pieces of hard deposits, large or small, the draw or pull stroke will be found most effective. The instrument is carefully carried a little below the gingival border of the gum and hooked securely over the shoulder of the deposit. Then with the hand properly braced, the

instrument is firmly drawn toward the masticating surface or cutting edge of the tooth—a second digital motion (Fig. 62). When the deposits are small and fairly soft a short pushing stroke will be more effective.



33 34 3

FIG. 43.—S. S. White scalers. Sickle scaler.

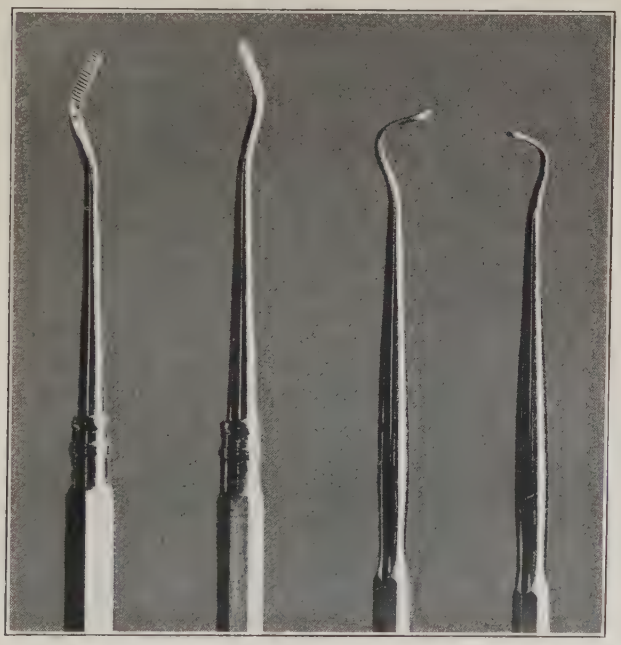
Scaling Heavy Deposits.—The large deposits of salivary calculus which are present in neglected mouths must be removed before true preventive treatment can be given. The removal of this calculus is not so difficult, as it can be seen either by direct vision or the use of the mouth mirror. In removing the heavy deposits the S. S. White sickle-shaped instrument No. 3 and scalers Nos. 33 and 34 will be found

most useful. In skilful hands it is possible to scale roughly nearly all the surfaces of all the teeth with these instruments, the exception being the approximal surfaces. No. 3 is used with a draw or pull stroke (Figs. 62 and 63), and has the advantage of not being as dangerous around the anterior teeth, for the point of the instrument as well as the side of the blade is inserted under the deposit and pulled directly upward on the lower teeth and downward on the upper teeth. But in the back of the mouth where its adaptation necessitates the drawing of the instrument forward under the border of the gingiva the point is likely to slip and travel too deep into the gingival space unless care is used. A firm hold on the instrument and a secure brace of the hand is absolutely essential. This sickle-shaped instrument is used almost entirely with a digital motion. Nos. 33 and 34 may be used with either a push or pull stroke, and can be adapted to the broad surface of any tooth. If the deposits are so heavy and numerous that considerable time, possibly an hour, is required for rough scaling, it is advisable to dismiss the patient and, at another sitting in two or three days, complete the operation by removing the remaining finer deposits which are not visible.

At this point it must be distinctly understood that the cleaning of teeth bears the same relationship to dental prophylaxis as plowing does to agriculture. The plowing is essential before the science of agriculture can be applied. The removal of the heavy deposits, large accretions and accumulations of stains and plaques is essential before the real science of prevention can be practised. A true prophylactic treatment must aid in the prevention, not only of dental caries, but of any of the departures from the normal of the supporting tissues of the teeth.

The mouths of patients receiving systematic prophylactic

treatment frequently do not present any visible accumulations of calculus, and many dentists would be prompted to remark that the teeth did not need scaling. Yet the most subtle enemy of the investing tissues of the teeth is present in the form of small calcareous nodules beneath the free gum margins. One of the great efforts of prophylaxis lies in the systematic and thorough removal of these deposits.



5 6 18 17

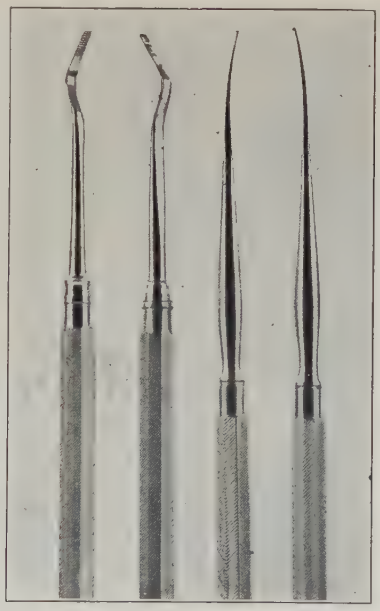
FIG. 44.—Smith set. Darby-Perry excavators.

Instruments.—The choice of instruments for this operation has been widely discussed, and there are dozens of scalers in the supply houses for this purpose. If the nature of the deposit to be removed is analyzed it will be seen that,

since the deposit is usually in the form of small scales, and attached to the portion of the tooth at the free margin of the gum, small delicate instruments are indicated. Not only is the sense of touch greatly magnified in the use of a small instrument, but it is not desirable to pass a thick, heavy blade beneath the free margin of the gum because of the danger to the attachment of the deeper tissues. Several instruments designed for this operation have sharp pointed ends which are successful in breaking up the hard scales, but may easily wound the tissue. The instruments which seem to fill all the requirements of the thorough removal of the small nodules of calculus are the Darby-Perry excavators, Nos. 17 and 18. They are delicate and small, and their spoon shape is utilized as a scoop with which to remove the calculus.

The lingual and buccal surfaces can be thoroughly explored and scaled by the Darby-Perry instruments, but the approximal surfaces are scaled and smoothed by the Smith files, Nos. 13, 14, 5 and 6. No. 13 is a file-cut instrument with a long thin blade, bent at an angle of 45 degrees, the file being on the under surface of the blade. No. 14 is the mate, with the file on the outer surface of the blade. The angle of the instruments makes them generally adaptable to the approximal surfaces of molars and bicuspids. Nos. 5 and 6 are also file-cut, but are straight, bayonet-shaped instruments, for reaching the approximal surfaces of the anterior teeth. After experimenting with many types of instruments, the author has failed to find any so productive of definite results, with minimum expenditure of time, as these file-cut instruments. Their advantage over the usual hook-shaped instrument is that each blade of the file is capable of engaging deposit, and several deposits can be removed with one pull stroke of the instrument. An even-

ness of pressure is exerted all along the blade of the file, leaving a smooth tooth surface. It is possible to use these files in approximal surfaces where there are rough unfinished fillings, and they are excellent to detect even a slight roughness.



13 14 3 4

FIG. 45.—Smith set. Harlan scalers.

The Harlan scalers, Nos. 3 and 4, are usually self-suggestive in their uses. They are used with a draw stroke under the gum margin to remove the very tenacious small deposits that might resist the Darby-Perry instruments.

Lower Jaw.—Assuming that the deposits are not unusual in quantity, and are reasonably easy to remove, the adapta-

tion of these instruments will be described, proceeding as in Fig. 33.

Starting at the disto-lingual angle of the right lower last molar, No. 18 of the Darby-Perry excavators is selected and held at the angle shown in Fig. 46. The stroke used is a short downward push, and a wrist motion is used with the

Fig. 46.

blade held at nearly a right angle with the tooth. On the downward stroke the back of the blade with its smooth, blunt surface will strike the gingival border of the gum and prevent the cutting edge of the instrument from traveling far enough to injure the subgingival tissues. This short stroke is rapidly repeated, the operator making a wave-like motion

of the instrument, gradually moving it forward, mesially, on the lingual surface of the molar until the mesio-lingual angle is turned, and using the mouth mirror with the left hand to keep the tongue out of the way. The instrument is now transferred to the next molar, and the operation is repeated. This is continued with the same instrument until the left lower central is reached, from No. 1 to No. 2 in Fig. 33.

Fig. 47.

The mate to this instrument, No. 17, is now substituted, and the operator, starting on the lingual surface of the left central (Fig. 47), and using a rotary stroke, continues until the disto-lingual angle of the left lower last molar is reached. (Fig. 48, or from No. 3 to No. 4 in Fig. 33).

Again starting at the disto-buccal angle of the left last molar with instrument No. 18 (Fig. 49), this short pushing

stroke with a wrist motion is used until the left lateral is reached (from No. 5 to No. 6 in Fig. 33). Although the same instrument can be used effectively on the labial surfaces of the incisors, it will be found advantageous to change for its mate, No. 17, and, leaning slightly in front of the patient, brace the hand by the third finger on the masticating sur-

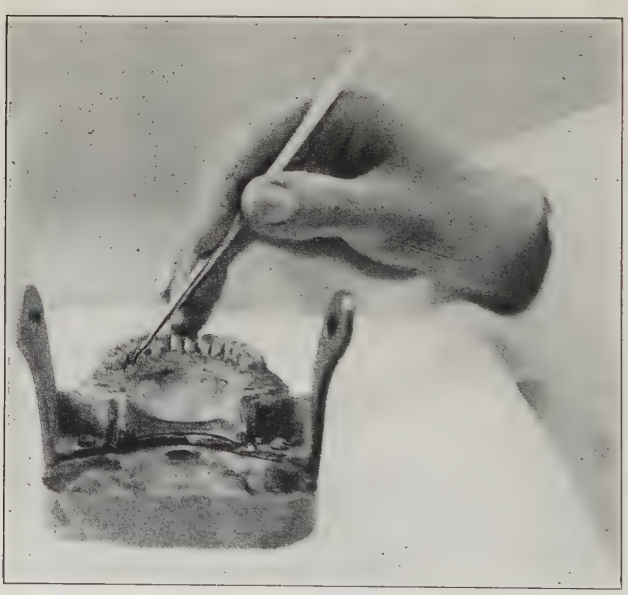


Fig. 48.

face of the first bicuspid (Fig. 50), using a wrist motion which permits of a careful handling of the festoons of the gums of the lower incisors. After the labial surface of the left lateral is finished the hand is moved forward to engage the next tooth. At the right cuspid the rotary stroke is now adopted and continued to the last molar (Fig. 51, or from No. 7 to No. 8 in Fig. 33). The finger rests for the

work just described are found on the masticating surfaces of the bicuspids or on the cutting edge of the cuspids or incisors.

Two of the four base lines of the teeth have now been covered, and there remains the approximal surfaces or the

Fig. 49.

distal and mesial lines. The instrument now used is No. 13, with a pull stroke, starting at No. 1 in Fig. 34, which is the distal surface of the right lower last molar, as shown in Fig. 52. The distal surface of the last molar being free, the blade is carefully passed down under the gum line until

the sense of touch determines the bottom of the subgingival space. The blade is then brought tight against the tooth surface and pulled upward. One-eighth to one-quarter inch play of the blade is sufficient to dislodge the deposits. This stroke is rapidly repeated across the back of the tooth. In adapting this instrument to the distal surface of the second

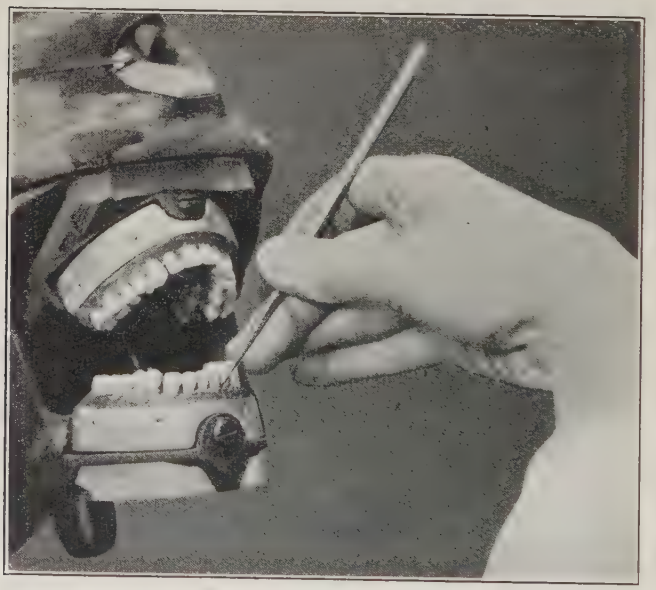


Fig. 50.

molar the blade is gently inserted sidewise from the buccal surface (Fig. 53), and with a short push-and-pull stroke the instrument is passed between the teeth to scale the distal surface. If the teeth are so shaped, or the interproximal space so filled with tissue, that the blade does not pass easily across the approximal surface, it is carefully inserted from both the buccal and lingual sides. In this way the accessible

surface of the tooth is scaled, but no effort must be used to force the instrument so as to injure the delicate interproximal tissue.

With the same instrument the distal surfaces of the teeth may be scaled to the incisors, or from No. 1 to No. 2 in Fig.

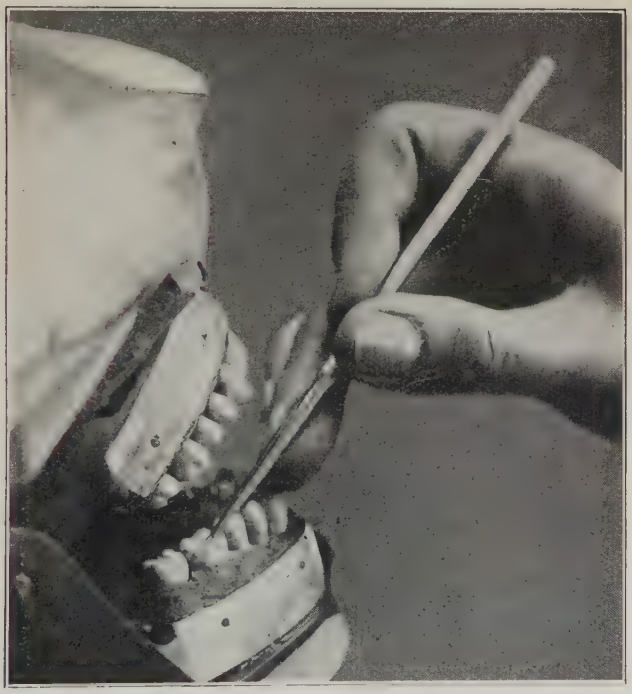


Fig. 51.

34. Again, with the same instrument, the operator should start on the distal surface of the left cuspid, and entering from the buccal side, proceed on to the last molar, or from No. 3 to No. 4 in Fig. 34. The procedure for the mesial surfaces is the same as described for the distal, except that

FIG. 52.

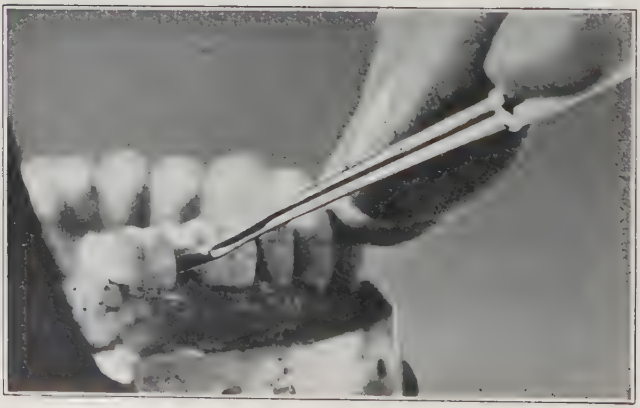


FIG. 53.

the instrument used is No. 14, and one position is illustrated as in Fig. 54. Both push-and-pull strokes are employed. The lower incisors are scaled on their approximal surfaces by the bayonet-shaped Smith scalers, Nos. 5 and 6, from No. 5 to No. 6 of Fig. 35, which shows this area. Fig. 55 illustrates the adaptation of these instruments.

FIG. 54.

Upper Jaw.—On the upper jaw, at the right disto-lingual angle of the last molar, instrument No. 17 is placed at nearly a right angle with the tooth and, with the hand braced on the top of the left lower lateral and cuspid teeth, using the third finger as a fulcrum (Fig. 56), a wrist and digital motion is employed, the instrument being made to travel forward with a short up-and-down push-and-pull stroke

combined, perhaps better described as a waving stroke. The fulcrum-point is maintained, the instrument being drawn in or shortened as the incisors are approached. When

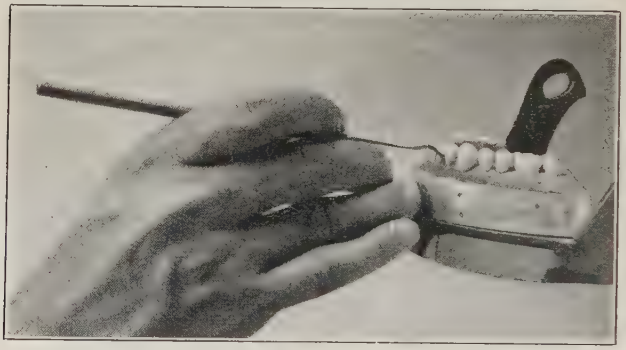


Fig. 55.

Fig. 56.

the left central is reached (Fig. 36) instrument No. 18 is substituted, the second finger used as a fulcrum on the cutting edge of the right upper cuspid (Fig. 57) and the

lingual surfaces of the upper teeth of the left side are gone over with a wrist and digital motion. This fulcrum-point is maintained and the instrument advanced in length with

Fig. 57.

the thumb and first finger (Fig. 58). Again starting at the disto-buccal angle of the left upper third molar, the third finger is placed slightly back of the cutting edge of the right

upper lateral and central while the second finger rests on the cutting edge of the left upper central (Fig. 59). This position can be held until the left lateral is reached, the motion being wrist and digital. Shifting the fulcrum-point to the end of the third finger on the edge of the right upper cuspid, the labial surfaces of the left central and lateral

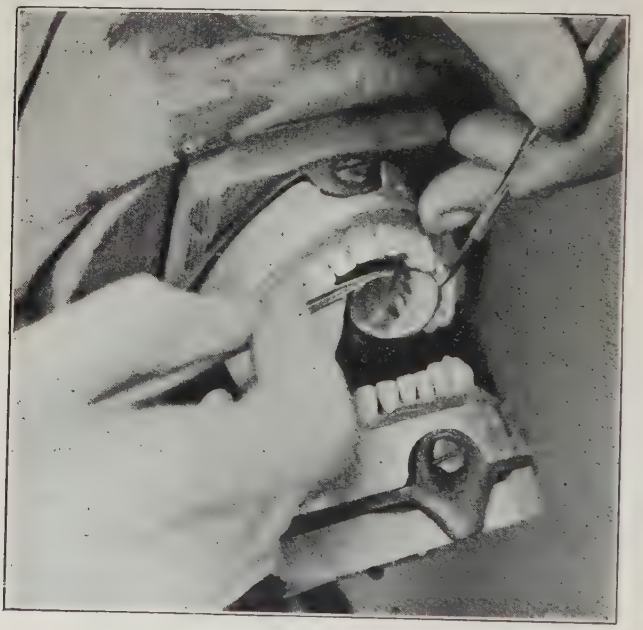


Fig. 58.

may be scaled with the same instrument. With the hand resting against the chin just below the lower lip, and the third joint of the little finger serving as a fulcrum, with instrument No. 18, the right central and from there back to and including the third molar is scaled, using the digital motion, as in Fig. 60.

Fig. 59

Fig. 60.

The lingual as well as the labial and buccal surfaces, having been covered, No. 13 is used for the distal surfaces (Fig. 37) of all the upper teeth excepting the incisors. For the molars, bicuspids and cuspids of the upper jaw the description of the use of this instrument for those on the lower jaw may be applied, the hand rest being found chiefly

Fig. 61.

on the cutting edge of the lower incisors, the end of the third finger serving for a fulcrum. No. 14 (Fig. 38) is used in a similar manner, with the hand rests the same as for No. 13. Nos. 5 and 6 are best adapted for the approximal surfaces of the incisors, their use at this point being self-evident.

The Harlan instruments, Nos. 3 and 4, are used with a draw stroke and are helpful in removing the small hard,

tenacious deposits under the free margin of the gums (Figs. 62 and 63). They are adaptable in nearly all sections of the mouth and their use is usually self-suggestive. When these small deposits resist Nos. 17 and 18, especially on the bicus-

Fig. 62.

pids, cuspids and incisors, these Harlan instruments will be found very effective.

If uncertainty exists regarding the thorough removal of all deposits, a small fine explorer should be passed under the gingiva around the neck of the tooth to detect deposits

or uneven surfaces. The smaller the explorer used, the greater the sense of touch is magnified. This procedure is advisable until the operator has proven to himself that he has acquired sufficient skill to thoroughly scale the surfaces of every tooth. It can readily be appreciated what a slow and painstaking piece of work it is to go over carefully each of the surfaces and remove all deposits, and it is only by

Fig. 63.

adopting a definite system of operating that any degree of thoroughness can be attained. From the standpoint of prevention, the operator who has perfected the technic of the prophylactic treatment is in a position to give his patients one of the finest services in dentistry.

There are two special features to be considered under instrumentation: (1) The sensitiveness that is frequently

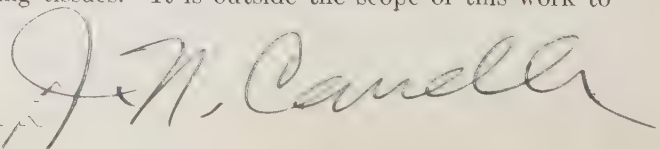
J. E. Nesbrook

found around the necks of the teeth, and (2) the bleeding of the gingival borders of the gums. In adults where the lime deposits have been heavy their removal will frequently cause much sensitiveness for a week or two, sometimes even longer, to heat and cold and to sweets and acids. The deposits have caused an absorption of the border of the alveolar process, the soft tissues and the cementum around the necks of the teeth, and when they are removed the interglobular spaces on the border between the dentin and the cementum are exposed, presenting an area that is highly sensitive to the touch of the instrument or polisher. It is frequently wise to inform the patient that he may expect the surfaces to be responsive to heat and cold for a short time, in order to allay any fears on his part. The deposits acting as a covering for these surfaces have protected them from external irritation, and the patients are apt to wonder why it is that their mouths are so much more sensitive than they were before the deposits were removed. Acids are especially irritating to these surfaces, and the use of bicarbonate of soda, half teaspoonful to a third of a glass of warm water, used as a mouth-wash two or three times daily, will aid greatly in tiding over this short period of discomfort. If the soda can be used clear by dipping the finger in water, touching it to the soda and then rubbing it on these surfaces, it will all the more quickly neutralize any acid that may be irritating to the sensitive tissue. The thorough rubbing and polishing with the stick and pumice and the extreme cleanliness from the faithful use of the tooth-brush will soon bring these troublesome areas under control. The application of a 10 per cent solution of nitrate of silver is sometimes advised, but if it is used it should be followed by a thorough polishing with the stick and pumice.

The second feature, which will be considered briefly, is

the bleeding of the gums during instrumentation. When the gums readily bleed there is congestion of the capillaries, and the more blood allowed to escape from the gingivæ, the sooner the congestion will be relieved. Instead of trying not to make the gums bleed, just the reverse course should be followed, though of course this does not mean that they should be lacerated or the tissue wounded. The bleeding process is produced by using the back or smooth surface of the blade of the instrument with pressure, and this is done while removing the lime deposits, and if there is a copious flow of blood from some of the approximal surfaces it should be encouraged by rapid, gentle pressure strokes directly on the gingivæ. Healthy gums will bleed but little during instrumentation, and when bleeding occurs enlarged and congested capillaries are sure to be found. No fear need be felt of causing injury to the gum tissue in producing a flow of blood as long as care is taken that the blade of the instrument does not cut the tissue. Frequently after this treatment the gums will take on a color two shades lighter before the patient leaves the chair, and after a few days of stimulation with the tooth-brush a marked improvement will be noted.

Treatment of Pockets.—The diagnosis of localized pain that is not the result of a carious tooth may seem difficult until it is realized that the pressure produced by engorged blood-vessels is quite frequently the cause of much pain and discomfort. This is particularly true in adult mouths, where the absorption of the supporting tissues of the teeth has formed so-called pockets and which require special treatment. Reference is made particularly to those mouths in which the pockets are due to local irritation in certain areas, and are not the result of a general infection of the supporting tissues. It is outside the scope of this work to



cover the treatment of pyorrhea alveolaris, but it seems within the province of preventive dentistry to outline the treatment of isolated pockets which will frequently restore a tooth to usefulness. It is rare that an adult mouth does not present certain areas in which there are incipient pockets which will eventually result in the loss of one or more teeth unless proper preventive measures are taken. As a general rule, a local irritation is producing the absorption of the investing tissues of the tooth, and each individual case will govern what is to be included in the removal of the irritation. It should include scaling of the teeth, first for the removal of the grosser deposits, then the fine subgingival calculus. Following this scaling, which is quite similar to the form used in the prophylactic treatment, a surgical instrumentation or curettement to remove deep deposits and smooth the root surfaces which have become denuded during the formation of the pocket. Certain cases require relief of traumatic occlusion which necessitates judicious grinding of the occlusal planes of the teeth.

In any case where the absorption of the tissue has been caused by ill-fitting and unsanitary crowns or poorly contoured fillings, it is necessary to remove the bad dentistry and substitute correct restoration.

Surgical Instrumentation.—Whatever the cause of the irritation which has resulted in a pocket formation, the surgical instrumentation is essential, in addition to the other measures needed to control the processes of absorption. This type of curettement should never be attempted until the operator has acquired the skill and delicacy of touch developed in the technic of the prophylactic treatment.

The object of the curettement is: (1) To remove all calcareous deposits; (2) to remove any particles of dead pericemental tissue that may be attached to the cementum;

(3) to plane the roughened cementum down to a smooth surface.

The initial instrumentation can be done with the Smith files Nos. 13, 14, 5 and 6, using the technic described pre-

Fig. 64.

viously. The adaptability of these instruments is such that the operator soon realizes their general usefulness. For the curetting of deep pockets, however, the blades of these instruments are frequently too thick and too short, and the fine planing of the root surface is secured with longer and

more delicate blades, such as the set of Improved Dentinol Prophylactic Files (Figs. 64 and 65).

Necessity for Extraction of Teeth.—The dentist who has acquired skill in surgical instrumentation, and experienced

Fig. 65.

the gratifying recovery of many cases, is liable to attempt to save teeth in a serious diseased condition. The menace that such teeth may be to the general health of the patient becomes a factor for grave consideration. It is undesirable to attempt the conservation of teeth which may produce

systemic infection, either by the constant exudation of pus into the mouth, or by the absorption through the lymphatics from the deep areas of infected pericemental tissues. The pumping action of loose teeth during mastication may force bacteria and their toxins into the blood stream, so that the general health of the patient should receive due consideration in any attempt to restore the teeth to usefulness.

Use of Drugs.—The use of drugs or antiseptic mouth-washes has very little place in the treatment of pockets. It is imperative that the numbers of microörganisms in the mouth be lessened, but drugs cannot be depended upon to obtain this condition. A drug powerful enough to destroy bacterial life has a depressing action upon, if it does not actually destroy, cell life, and, further, the action of any drug is effective only for a brief period. Bacterial life cannot be maintained without food, and the most certain method of inhibiting bacterial propagation is the maintenance of rigid cleanliness in the mouth. All surfaces of the teeth should be swabbed with peroxide of hydrogen before instrumentation, and Churchill's compound tincture of iodin may be applied to the inflamed gingival areas, and even in the deep pockets after the treatment. The iodin is not destructive to the cells, and aids in reducing the inflammation and soreness. Otherwise no drugs are indicated, and so-called germicidal mouth-washes or vaccines should never be used. *The greatest dependence must be placed upon the normal forces of repair*, for with just a little help the response of the tissues is remarkable. The cure, as well as the prevention, of absorption of the investing tissues is, therefore, dependent upon mouth hygiene.

The dentist must assume the responsibility of placing all tooth surfaces in such condition that it is quite possible for the patient to keep them free from food débris; he must also

teach the patient the most effective means of caring for his mouth to remove food débris. The fact that the patient must follow such procedure faithfully, at least three times daily, makes it apparent that once the dentist has placed the mouth in a favorable condition; the success or failure of the treatment lies entirely in the hands of the patient.

If, in addition to the proper diet, his coöperation can be secured to keep the mouth free from food débris, and stimulate a perfect flow of blood to the tissues, the most gratifying results can be expected. The gums assume their normal color and firmness, and in some cases will adhere tightly to the tooth surfaces, thereby closing the pockets at the gingival margins.

The reattachment of the fibers, or the formation of new tissue, cannot generally be expected, so that every effort should be made to maintain a normal gingiva which is the most practical prevention of pocket formation.

Polishing.—It is impossible to obtain the same results in prophylaxis with the use of the dental engine in polishing as may be secured with the hand polishers. This belief is based upon personal experience in faithfully trying out both methods, and is an accepted fact by all prophylactic workers who have become proficient with the hand polishers.

The object of this polishing process is three-fold: (1) The removal of stains, plaques and films or all soft accretions on the exposed surfaces of the teeth; (2) a polishing of the enamel surfaces and a stimulating effect that seems to be imparted to the living tissue of the tooth itself by the vigorous massage; (3) the beneficial results obtained on the gingival borders of the gums by the slight bumping of the stick, causing light pressure and release which imparts a massage effect and aids greatly in producing a perfect flow of blood through the capillaries in the peripheral circulation.

If a new case presents itself in which the teeth are very badly stained, it is perfectly reasonable, if desired, to use the dental engine for the first treatment to aid in cleaning off these stains from the enamel surfaces, but all subsequent treatments should be made with the hand polisher. An engine revolving at six or eight hundred revolutions a minute, with the rubber cup or buff charged with pumice, cuts too viciously, and if used at each prophylactic treatment will in time affect the enamel and tooth structure at the necks of the teeth. With the dental engine all sense of touch is lost, and besides it is not as adaptable on all surfaces as the stick held in the hand. The gingival borders of the gums in many mouths have been badly wounded or damaged by the revolving cups or buffs in the dental engine, and if one hopes and expects to secure the best results in obtaining ideal health conditions of these tissues one must become proficient with the hand polishers. Those who would advocate the dental engine are those who have failed to make themselves proficient with the hand polishers. There can be no choice if the latter is faithfully tried. There are a number of different woods that may be used for polishing, as cedar, maple, hard pine, etc., but the closest-grained wood and the one best adapted for this purpose is orange wood. There are two sizes of sticks that may be had from the dental depots, known as large and small. The large size is cut about three-quarters inch in length and one end is trimmed wedge-shaped. This stick is used on all the broad surfaces of the teeth excepting the masticating surfaces. The small stick is cut about the same length and one end is sharpened like the point of a lead-pencil. The smaller stick is used on the approximal surfaces and around the necks of the teeth where it is impossible to adapt the larger stick. In order to work with facility two holders for the two sizes of sticks

should be employed. Fig. 66 illustrates the Jack porte polishers with sticks in position. For the purposes of heat sterilization the metal handles are preferable to wood.

As a slight abrasive and polish to be used with the sticks the finest grade of pumice moistened with water will prove to be the most satisfactory. Although other polishing mediums are used with good results, it is doubtful if there

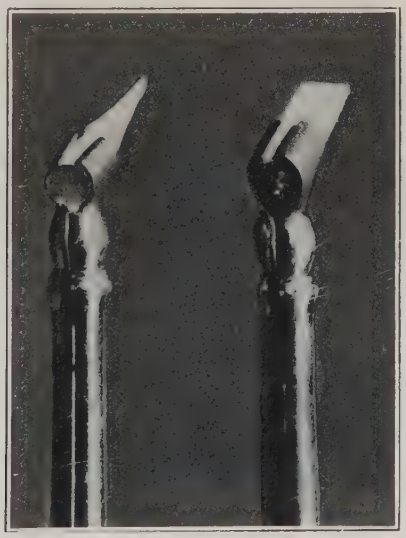


Fig. 66.

is anything superior to fine pumice for this special work. A scant spoonful placed in a small porcelain dish, and wet sufficiently with water to be almost liquid, will make a mixture that can readily be picked up on the point of the wet stick and used in the mouth.

System of Polishing.—Just as a definite system is employed in going over the teeth with the instruments, so should a

system for reaching all surfaces of the teeth with the polishers be followed.

The following system is very effective and its adoption is advocated.

Starting on the labial surface of the right upper central with the large stick, the polishing progresses to the right lateral, then to the right cuspid and so on until the right last molar is reached. From this point start on the buccal surface of the right lower last molar and progress forward

Fig. 67.

around the buccal and labial surfaces of all the lower teeth to the left lower last molar. Transferring the stick to the buccal surface of the left upper last molar, the polishing is continued forward to the median line to and including the left upper central. All the labial and buccal surfaces have now been polished with the use of only the larger stick. Fig. 67 illustrates direction for polishing. Then starting on the lingual surface of the right lower last molar with the large stick, the polishing of the lingual surfaces proceeds

forward to the incisors, then backward, or distally, to the lingual surface of the left lower last molar. Again beginning on the lingual surface of the left upper last molar, all the lingual surfaces are covered, ending on the right upper last molar.

So far only the large stick has been used. Now with the pointed stick the same course should be followed over the teeth as has just been described, polishing in between the teeth as far as possible and rubbing the necks of the teeth under the free border of the gingivæ, keeping the edge of the stick sharp. When the sticks become frayed or brush-like they should be trimmed off with a pair of scissors, or if after this the edges are still to blunt, sharpened with a knife.

The polishing is confined almost entirely to two motions—the rigid-arm and the forearm, or rotary. The one exception is the digital that should be used by beginners on the labial surfaces of the upper incisors.

In order to polish effectively pressure must be used. It is this one point of being able to apply pressure on all the surfaces while polishing that makes the operation difficult. This is noted especially in polishing the lingual surfaces of the molars and bicuspids. The proper hand-rests are essential and also muscular practice of the motions used for this work.

Beginning on the labial surface of the right upper central with the large stick, and using a digital motion, the stick is made to travel up and down the full length of the face of the tooth, rubbing the surface with both up and down strokes. The stick is allowed to bump the gum lightly but not hard enough to cause discomfort. Considerable pressure is used and the motion is rapid. Fig. 68 illustrates the position of the hand with the thumb-rest on the cuspid for the digital motion. When the right cuspid is reached the

rigid-arm motion is employed, with the back of the second finger, between the second and third joints, resting on the side of the chin and the two bicuspids are rubbed and polished up and down or longitudinally, the right thumb pressing on the polisher at the end of the stick (Fig. 69). Now inserting the Dunn cheek distender, the buccal surfaces of the molars are rubbed crosswise, using the rotary motion and the same fulcrum position that was used with the cuspid

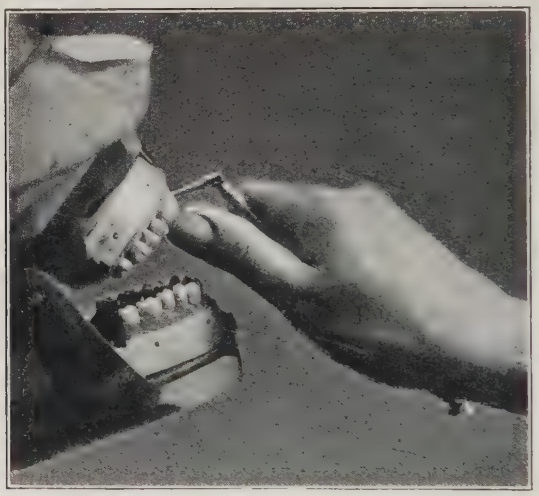


Fig. 68.

and bicuspid, but the porte polisher is shifted in the hand and grasped as one would hold a pen (Fig. 70). The end of the stick may be made to travel up and down part way on the approximal surfaces, but the principal motion for polishing is crosswise. The polishing of the right lower molars is the same as described for the upper molars. For the right lower cuspids and bicuspids the same as for the upper. The first finger of the left hand now is placed

FIG. 69.

FIG. 70.

across the inside of the lip to depress it, and with the polisher grasped in the fist with right thumb resting on the left forefinger (Fig. 71) the lower incisors are polished. For the left cuspid and bicuspids the same position as for the right is used. In polishing the left lower and upper molars the back of the third finger becomes the fulcrum on the side of the chin and the polisher is grasped pen-holder fashion,

FIG. 71.

as in Fig. 72, using the rigid-arm motion. The descriptions of the right cuspid and bicuspids, lateral and central, will apply to the left. It will be noted that, with the exception of the upper incisors and right molars, the motion used on all the outer surfaces of the teeth has been rigid-arm. That on the inner surfaces of both lower and upper is forearm or rotary. The difficulty met with is that of producing pressure and at the same time retaining control and length of

stroke. With the mouth mirror in the left hand to hold the tongue away, the back of the third and fourth fingers are pressed against the chin, and the polisher held as the pen-holder in a rigid grasp (Fig. 73), the stick is made to travel

Fig. 72.

up and down on the inner surface of the right lower molars, the edge of the stick pointing up and down with the long axis of the tooth. This polishing motion it will be noted is just the reverse from that used on the buccal surfaces.

By shortening the hold on the polisher the same position is used for polishing the bicuspids and cuspids.

Other adaptations of the stick will be found that are advantageous for these surfaces, such as using the side of the stick with an up-and-down stroke instead of its sharpened end.

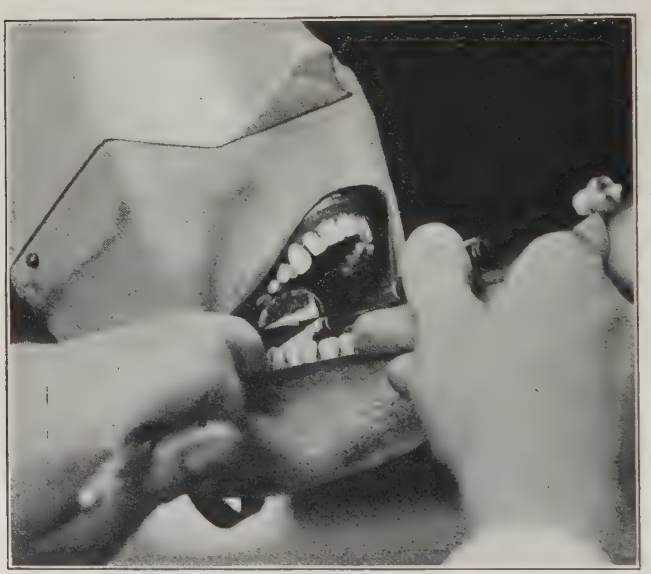


Fig. 73.

By leaning forward in front of the patient the second finger is placed on the top of the left cuspid or bicuspid and with a rocking or rotary motion of the arm and stick the lower incisors are polished (Fig. 74). The left lower molars are polished with the same pen-holder grasp, using the second finger as a fulcrum on the right lower cuspid or lateral (Fig. 75). The mouth mirror can be used to good advantage while polishing the lingual surfaces by having the

Fig. 74.

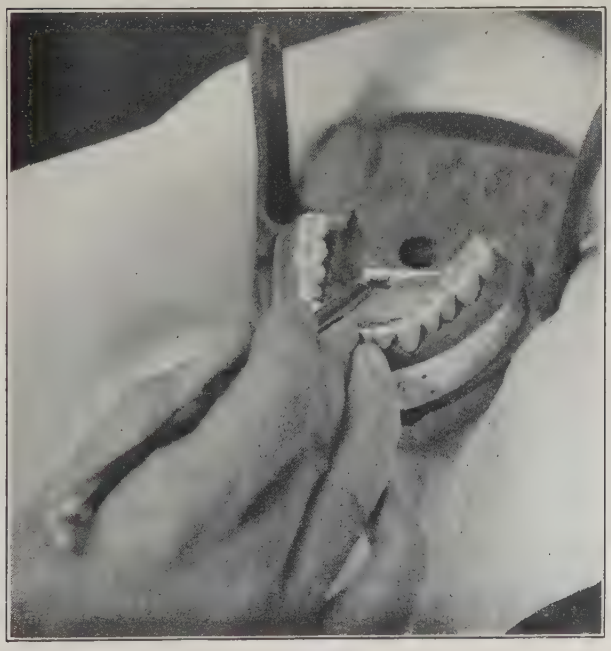


Fig. 75.

patient low enough. Starting on the lingual surface of the left upper last molar, the porte polisher is held like the pen-holder, and, with the end of the third finger resting on the labial surface of the right lower cuspid (Fig. 76), the molars are rubbed chiefly up and down with the edge of the stick. Holding the same fulcrum-point, the grasp on the polisher is gradually shortened and the incisors are polished, as shown in Fig. 77. The lingual surfaces of the right cus-

Fig. 76.

pid, bicuspids and molars are polished with the same hold of the polisher, the rest being found on the chin, using the back of the second joint of the third finger (Fig. 78). The motion used is mostly forearm or rotary.

All the positions and fulcrum-points described for the large stick apply also to the small stick.

Where the gums between the teeth are congested, the side of the stick is pressed against them with a fast, quick

Fig. 77.

Fig. 78.

stroke to encourage the bleeding. Care should be taken in the use of both sticks not to abrade the gingivæ, but the light pressure with the side of the stick against the gum margin will prove very beneficial (Fig. 79). When sensitive surfaces are found at the necks of the teeth the pointed stick freely charged with pumice is applied with vigor and considerable pressure. A thorough polishing of their surfaces will greatly aid in reducing the sensitiveness.

Fig. 79.

Floss Polishing.—After polishing with the sticks there still remain the contact points and an area on the approximal surfaces that have not been reached. By doubling a length of ligating silk, twisting it and dipping it in water and then in pumice, these surfaces may be polished quite effectu-

ally. When the teeth are very close together a single strand will be found sufficient, as this silk is larger in size than that sold for every-day flossing. Wide ribbon floss may also be used to advantage where the space will permit. When using the floss for polishing it should be passed between the contact points with care, so that it will not snap on the gum, drawn back and forth on the distal surface of the

Fig. 80.

tooth and then pressed backward rubbing the mesial surface of the adjoining tooth. If the ends of the floss are wound around the first fingers, as illustrated in Figs. 80 and 81, it can be easily manipulated. The chief benefit to be derived from a thorough polishing of the teeth is the prevention of initial decay, and all efforts at thoroughness, especially on the masticating surfaces of the teeth where the great major-

ity of cavities are formed will do much in reducing the high percentage of caries occurring in these areas.

Brush Wheel.—The masticating surfaces are so uneven that a stick cannot be used on them very well, so it will be necessary to use a brush wheel in the engine to reach down in the grooves to polish these surfaces. With the wheel dipped in water and the edge of it touched to wet pumice, the engine

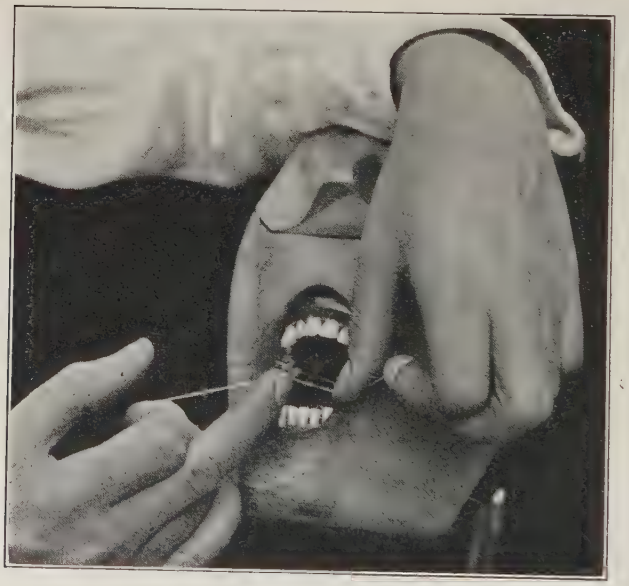


Fig. 81.

should be run at a moderate speed and the edge of the wheel applied in the grooves of the molars and bicuspids. The Dunn cheek distender should always be used. It is almost unnecessary to state that the sticks, the pumice, the floss and the brush wheel should not be used a second time. Figs. 82 and 83 show the adaptation of this wheel.

Fig. 82.

Fig. 83.

Children.—In the prophylactic treatment of children it is seldom necessary to use the instruments. As it is the roots of the teeth that are most susceptible to disease in adults, so are the masticating and approximal surfaces most susceptible in children. These surfaces should be carefully polished with the floss and pumice, and the grooves in the masticating surfaces with brush wheel in the engine. The polishing of all the surfaces of the teeth with the sticks should be done as described for the adult.

HOME CARE OF THE MOUTH.

Brushing.—A remarkable condition of health and beauty of the teeth and gums, and a high resistance and increased vitality of the pericementum and alveolar process, may be developed by a proper form of mouth-brushing. Normally these conditions should exist as the result of using a natural food supply, containing many coarse hard foods which require vigorous functioning of the teeth and jaws. Unfortunately the use of natural foods has been replaced by highly processed substitutes from which the coarseness is removed, so that the need for masticatory effort is greatly diminished, with the resulting detrimental effects upon the teeth and their supporting structures. To replace the benefits derived from natural living, which now seems almost impossible, the artificial production of similar effects is attempted in the several forms of exercise and physical culture. Applied to the dental tissues various methods have been devised to artificially stimulate an adequate blood supply to compensate in some degree for the loss of normal function, which would be accompanied by normal circulation so essential to the health of all tissues. It is evident that the most efficacious system of artificially stimulating the

circulation in the dental tissues is one which is designed to simulate, in so far as possible, the method and result of natural function. In this connection it is well to consider the blood supply to the dental tissues before describing the author's method of artificial stimulation, which is based upon these physiological principles.

Blood Supply.—The blood supply to the pericementum may be described as follows: The small arteries entering the apical space break up into branches, one or more of them entering the pulp canal through the apex of the root, and the others passing down between the fibers of the pericementum. During their course through this tissue, on their way to the alveolar border and the gums, they both give off and receive branches through the alveolus, and connect with the plexus of small bloodvessels and capillaries of the gum tissue. *It will thus be apparent that the blood circulation in the gums is very intimately associated with the circulation of the pericementum and alveolar process.* It frequently happens that, when an alveolar abscess develops at the apex of the root of a tooth the bloodvessels in the apical space are destroyed, yet the pericementum does not suffer from lack of blood for the branches coming to it from the walls of the alveolus soon enlarge and produce a sufficient supply. *It must, therefore, be noted that in order to stimulate the blood supply to the pericementum it is merely necessary to stimulate circulation in the gum tissue* (Fig. 84).

Fibers of the pericementum radiate into the gum tissue and strong bands of fibers which form the dental ligament blend into the periosteum of the alveolar process. Some of these fibers are so close to the surface in the gum tissue that it is not difficult to understand why an unusual response to health may be obtained by surface stimulation.

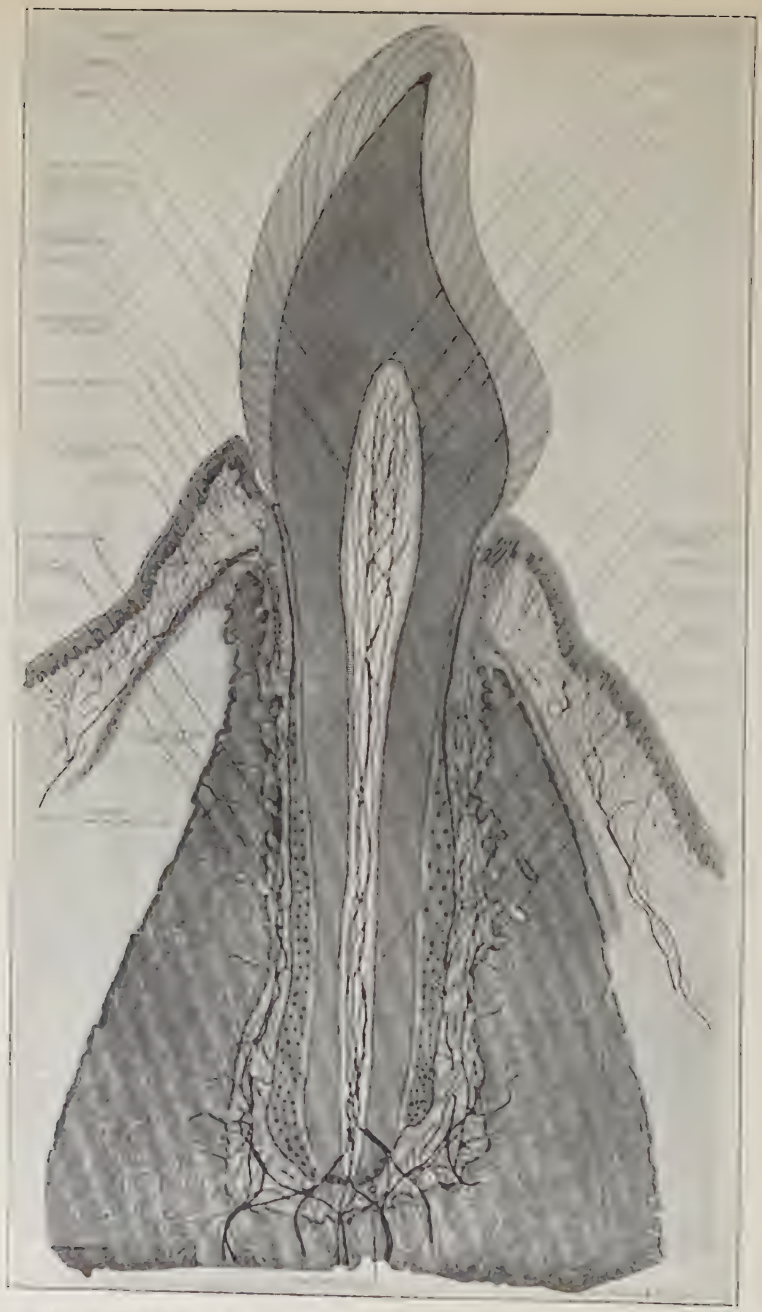


FIG. 81.—Showing blood-vessels of the pulp, the periosteum, and the gum. The bone is represented as much too dense, and so does not show the great vascularity of this tissue. (Noyes.)

Nature's Method of Stimulation.—During the mastication of coarse, hard foods a natural stimulation of increased circulation takes place in the following manner: The teeth being occluded with considerable force, are pressed down in their sockets. The pericementum is thus compressed and the blood is squeezed out of the small vessels into the branches radiating through the walls of the alveolus. As the jaws open and release the pressure on the teeth, the pressure upon the small bloodvessels of the pericementum is also released and the blood comes rushing in again. This pressure and release upon the bloodvessels is a natural form of stimulation to the circulation in the deeper tissues, and there does not seem to be any artificial method which simulates the effect obtained by normal functioning of the teeth during vigorous mastication. In addition to this benefit of natural function the coarse foods moving over the surfaces of the teeth slide upward over the the upper gums and downward over the lower gums, creating friction which results in stimulating the circulation of the gum tissue. In a normal denture the gingival septum, extending as it does somewhat beyond the interproximal space bucco-lingually, receives this frictional stimulus, but its delicate conical portion occupying the interproximal space is adequately protected by the contact point. Although the friction is received only on the buccal and lingual surfaces of the gums, the stimulus is transmitted through the network of bloodvessels to the interproximal gingiva, as well as the deeper investing tissues.

Another effect of the friction produced by coarse foods sliding over the gum tissue is a thickening of the gingival epithelium. The mucous membrane of the mouth is but a continuation or an infolding of the skin. Its epithelium is of the squamous type, similar to that of the skin. In the basement layer of the mucous membrane of the gums, cells

are formed constantly and forced slowly to the surface. During their transit the shape of the cells is changed to a long flat appearance, and they finally form the squamous epithelium. From the time of their formation to their arrival upon the surface of the gums, a change takes place in the protoplasm. The cell content begins to toughen, and the process continues in proportion to the needs of protection against friction. The mouths of many animals present the thickened epithelium resulting from increased activity of these cells in response to the stimulation produced by the friction of coarse food. The color of the tissues is light pink. The toughened surface of the gingival epithelium affords additional protection to the underlying tissues against bacterial infection or mechanical injuries.[1]

It is upon this physiological basis of frictional stimulation that the author's method of mouth-brushing is designed, in an effort to produce artificially the conditions which should be the result of normal function.

The Average Gums.—The condition of the circulation in the average mouth may be considered as indicative of the tone of the underlying tissues. The body of the average gum tissue is red, the gingival border usually showing even a deeper red. The mucous membrane is thin and has a smooth, glassy or sleazy appearance. The flow of blood is very sluggish, and on some of the margins the tissues will bleed at the slightest touch.

Waste products are not being properly eliminated, oxidation is imperfect and blood serum oozes in the subgingival spaces and forms an ideal medium for bacteria. The general tone of the tissues is exceedingly low and adequate resistance to disease is lacking. These are the average gums of

[1] See Keratin, p, 22.

adults who eat food which requires but little mastication and produces but little friction on the gums, and who take scant care of their mouths.

Effect of Artificial Stimulation.—All of these conditions will quickly change under artificial stimulation. The instant the gums are brushed properly the blood starts to flow more rapidly and a new life and color make their appearance. After a thorough prophylactic treatment and a lesson in mouth-brushing it is not unusual to see the tissues lighten in color, possibly two or three shades in twenty-four hours. At the end of a week or ten days they assume a still lighter shade, and after periods ranging from three to six months become a light pink, and hold this color so long as they are daily brushed and stimulated.

There is a shade of pink indicative of normal circulation in the dental tissues with accompanying increase in the tone and resistance of these tissues, which any one may acquire by daily artificial stimulation. The color is an important diagnostic point in the condition of mouth health, and it should be uniform in all parts of the mouth. The gingival border particularly should show no difference in shade from that of the body of the gum.

The normal color that the gums assume under the daily stimulation is due to the fast flow of blood through the capillaries, the perfect oxidation in the cells and thorough removal of waste products, as well as a thickening of the layer of epithelial cells on the surface. The mucous membrane looses its thin glassy appearance and looks tough and firm. If the gingival border is dried it does not weep (Fig. 85).

It must not be assumed that the miraculous happens and that by merely learning how to brush the gums will eliminate all present and future diseases of the mouth. However, one cannot help being enthusiastic when viewing the rapid

improvement in the health of the dental tissues under artificial stimulation. The pericementum seems to acquire new life, and apparently feels the stimulation in every fiber and cell. Loose and sore teeth become tight and free from soreness, providing that too much of the supporting tissue has not been lost.

There is no doubt but that the osteoblasts under prophylaxis and this stimulation, do at times replace small areas of the lost alveolar process. Where roots have been

FIG. 85.—Healthy gums, produced by artificial stimulation of blood supply. (Bunting.)

exposed on the labial or approximal surfaces, especially those of the incisors and cuspids, it is not uncommon to see gum tissue creep back over the exposed root to a considerable degree, and on the approximal surfaces to find that there has been a filling-in of the bony tissue to support the gum, which is undoubtedly a new deposit of process. When it is considered that the osteoblasts are present throughout life, and slowly add to the alveolar wall of the socket, it is not unreasonable to expect them to lend their aid when irritating factors are removed and a rapid circulation induced. Under

similar treatment pockets will contract, and soreness be greatly relieved as the tissue closes tightly upon the root.

Frictional Stimulation Produced Artificially.—The normal condition of health evidenced by characteristic color and texture of the gingival epithelium may be induced by simulating, with a specially designed brush, the functional stimulus of natural coarse foods passing over the gums during vigorous mastication. As hard food is crushed, some of it passes on the inside and some on the outside of the teeth, the latter traveling in two directions. Part of it passes upward over the buccal surfaces of the upper teeth and gums and downward again, while part passes downward over the lower teeth and gums, then upward, the muscles producing a churning effect and carrying it in a circular path back to the occlusal surfaces. The brush then should follow a similar path and is used with a light, circular motion, which not only accomplishes a physiological type of stimulation, but effectively removes food débris. The gingival borders are in relief so that the sweeping circular motion is thoroughly cleansing to these areas as it follows the curved line of the festoons. The friction produced by the rapidly moving bristles is mechanically cleansing to the broad tooth surfaces and to a third of the approximal surfaces.

The Brush.—Opinions vary greatly concerning the desirable size and shape of brushes. If it were only necessary to design a brush adapted to the crowns of the teeth there would be less dissension, but the brushing of the gums and the roof of the mouth is of equal importance to brushing the teeth. In fact the operation might well be termed *mouth-brushing*. It, therefore, is necessary to use a brush of a size and shape that will adapt itself to all the varying surfaces of the mouth. This is a *mouth-brush*, in contradistinction to a *tooth-brush*.

Many of the popular brushes on the market are nearly concave in shape, having a long toe and heel with the shorter bristles near the center. Such a brush, placed squarely across the front teeth, seems to fit when at rest, but if slowly moved about the mouth it will be found to ride in many places on the toe and heel alone. An undesirable pressure must be used to bring the short center bristles in contact with the tissues. Although the cranium is convex in shape, it has never been deemed expedient to use a concave hair-brush. In fact, a concave brush would not be as

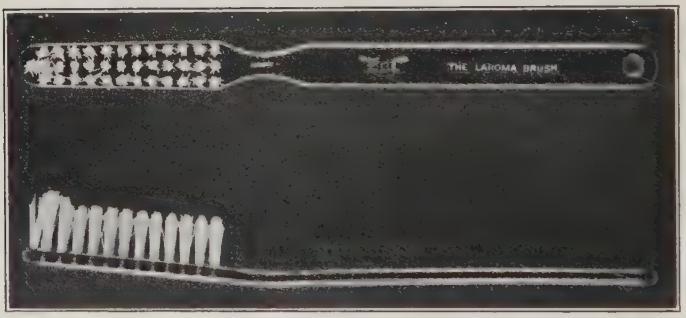


FIG. 86.

effective as a straight one, although it might seem to fit better when at rest. *A straight line is best adapted to all irregular convexities.*

The Laroma[1] brush, which the author has designed for his own method of mouth-brushing, is a straight cut brush with a slightly tufted toe end. The bristles are of sufficient length (12 mm.) to be flexible, yet with enough stiffness and spring not to lose life after the first few days' use. The bristle tufts are crowned and set three rows in width (10 mm.) and twelve rows in length (50 mm.). The brush is large

[1] Agents, Holton & Adams, 29 East 22d St., New York City.

and is so designed to obviate the danger common to all forms of gum-brushing, which is undue pressure with subsequent abrasion of the gingival epithelium. The pressure is diminished and more evenly distributed when a large brush is used, while a small brush considerably increases the pressure per bristle end. This point is illustrated by the example of the armored tanks used in the recent war. Some of the tanks weighed 40 tons, but were able to travel over soft marshy ground because their broad caterpillar tracks distributed the weight over such a large surface that it amounted to but 7 pounds per square inch. Lighter vehicles with wheels would sink in the soft ground because the pressure of the weight was concentrated upon a relatively small area.

According to the same principle the pressure per bristle end when distributed over the surface of a large brush is greatly diminished in comparison to the pressure per bristle end exerted by a small brush.

Instruction in Brushing.—Very few patients follow a definite system of brushing, or have the ability to effectively remove food débris unless taught to do so. A description of a method of brushing is not readily understood, so that a demonstration at the wash bowl with both the instructor and the patient going through the system is the most satisfactory way to teach. The time consumed in teaching a system of mouth care is justified by the results secured. If the following rules are honestly observed the same good results are assured in every mouth.

1. The shape and size of brush as advocated.
2. The system of brushing as described.
3. Brush long enough—not less than *two minutes* each time.
4. Brush (when possible) four times daily.

Occasionally cases seem baffling because the mouth does not respond to stimulation, but when the patient is asked to give another demonstration at the wash bowl it will show that he has failed to grasp the technic, or is not employing it sufficiently to produce the desired effect.

Fig. 87.

The brushing of the mouth may be divided into three parts:

1. The outside or buccal and labial surfaces of the teeth and gums.
2. The inside or palatal and lingual surfaces.
3. The occlusal surfaces of the teeth.

The Buccal and Labial Surfaces.—With the brush held in the hand, as in Fig. 87, and with the teeth nearly closed, the

brush is placed inside the cheek on the left side, so that the ends of the bristles are lightly in contact with the gums over the upper molars. Now, with a fast, circular motion the brush is swept backward and downward, reaching as far down on the lower gums as the brush can travel in this position, then forward and upward as high as possible on the upper gums (Fig. 88).

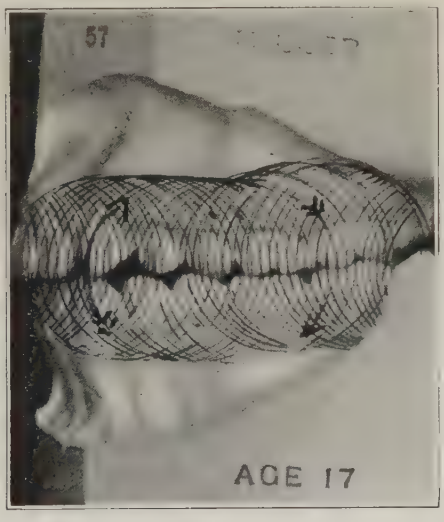


Fig. 88.

The brush should travel in a perfect circle, not in an oblong tract, and in as large a circle as the vestibule of the cheek will permit. *Very little pressure should be used,* for the stimulating as well as the cleansing process is accomplished by the rapidity of the stroke and the direction traveled by the ends of the bristles. Continuing this fast, light, circular motion, the brush should be made to travel very slowly forward until the heel (the bristles nearest the hand are

called the heel) engages the right cuspids. The incisors should be brought together in an end-to-end bite to insure the brush reaching the lower teeth and gums. Frequently the muscles of the lower lip contract and prevent the brush from traveling over the gums of the lower incisors. This can be obviated by holding the lip down with the left hand. Pausing on the incisors to stimulate thoroughly the gums on both jaws, start back again slowly to the region of the molars (Fig. 89).

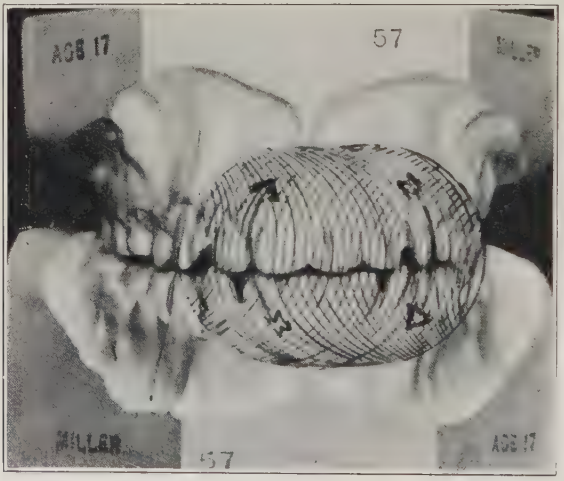


Fig. 89.

It will be understood that the brush is constantly in rapid motion, traveling in a large circle with the ends of the bristles lightly touching the gums and teeth.

Fig. 90 illustrates the position of holding the brush for the right side. On this side some persons find it easier to maintain a circular motion by reversing the stroke or brushing from the lower gums backward and upward. It makes

no difference in which direction the brush travels so long as the circular stroke is adhered to. Assuming that one is using the right hand for brushing, it will not be possible to brush farther forward than the right cuspid teeth (Fig. 91). Directions for brushing the left side are applicable to the right.

FIG. 90.

Lingual Surfaces.—1. Upper: The brush should be held as shown in Fig. 92. The roof of the mouth as well as the lingual surfaces of the upper teeth are brushed with an in-and-out stroke, as in Fig. 93.

The festoons on the palatal and lingual surfaces cannot be properly brushed with the circular stroke. It may be noted that they assume a much straighter line than on the buccal and labial surfaces. Therefore the bristles traveling

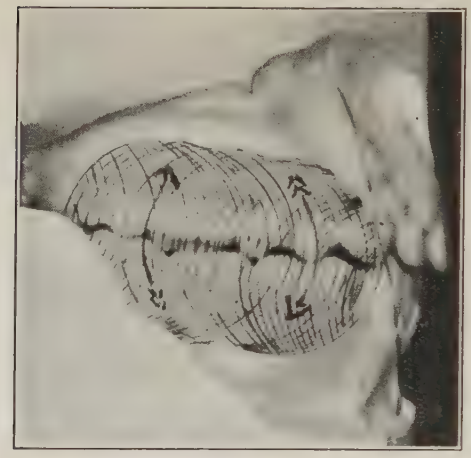


FIG. 91.

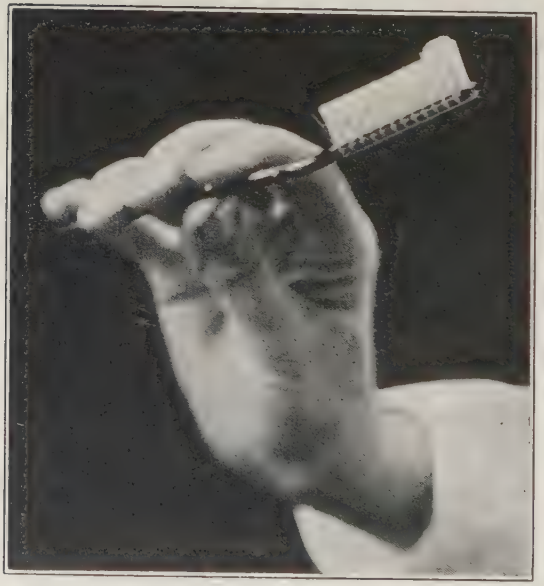


FIG. 92.

in and out with this straight line reach all surfaces and are stimulating and non-irritating in their action.

The ends of the bristles should be placed against the gums and the right molar teeth, and the brush drawn straight forward until the heel wipes the lingual surfaces of the right cuspid and incisors and protrudes from the mouth for a short distance. The upper lip should be drawn down to prevent the moisture from being thrown outward by the snap of the bristles passing over the edges of the incisors.

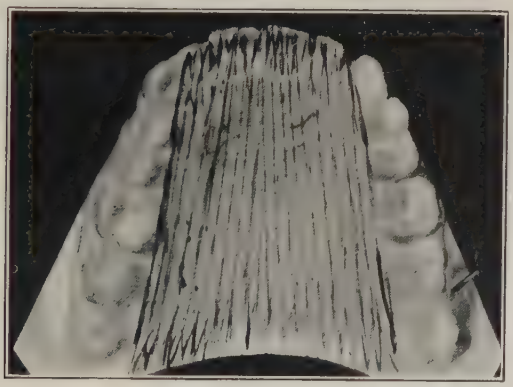


FIG. 93.

The brush is now pushed straight back again, and this in-and-out stroke is rapidly made and confined on these surfaces for a few seconds. This fast in-and-out stroke of the brush is kept up and carried across the roof of the mouth until all of the hard palate is covered and the gums on the left side of the mouth are reached. Here the in-and-out stroke is applied rapidly for a few seconds, as far back as the lingual surface of the third molar. The same stroke should be used on the return, the palate should be crossed to the right side again, and again back to the left side.

Special care should be used to reach the gums around the last molars, as there is a tendency not to brush back far enough.

2. Lower lingual surfaces: The lingual surfaces of the lower teeth are the most difficult to brush, and it requires quite a little practice before the gums, especially on the right side, can be deftly reached. Nineteen out of twenty

Fig. 94.

mouths will disclose a congested gingival border on the lingual surfaces of the right lower molars, and in order that the wrist may bend freely so that the toe of the brush may reach this surface, it is suggested that the brush be held in the hand as in Fig. 94.

These surfaces are brushed almost entirely with the toe or tuft of the brush, the motion being a fast in-and-out

stroke, similar to that used on the hard palate, as in Fig. 95. Starting on the right side with the bristles of the tuft resting on the gum near the last molar, the brush is drawn forward. In this case the bristles at the heel do not sweep the lower incisors as the handle of the brush is tipped slightly upward.

The brush is now forced backward in the same line, leaning slightly toward the tongue, and the in-and-out stroke is applied rapidly to the teeth and gums. Maintaining always this fast stroke, and slowly coming forward, the handle of the brush is now raised to a sharp angle and the

Fig. 95.

gums and incisors are brushed with an up-and-down stroke, going back and forth across them several times. The tuft is now adapted to the teeth and gums of the left side, and they are brushed in a manner similar to that described for the right side, again slowly returning to the right and repeating once more to the left side. A slight gagging sensation will sometimes be felt in trying to reach so far back as the brush should actually go, but with persistent practice this can be greatly overcome in a short time.

3. Occlusal surfaces: Lastly the occlusal surfaces should be brushed vigorously in order to remove any food débris in

the grooves of the molars and bicuspids. The tuft of the brush should also be carried to the distal surfaces of the last molars on both the upper and lower jaws and with a wiping or twisting motion these surfaces should be cleansed.

The foregoing description of brushing gives but a stereotyped form. The mouth should be gone over three or four times until the gums begin to tingle and a slight sense of numbness is felt.

Fig. 96.

In the roof of the mouth are the posterior and anterior palatine arteries which help to supply the gum tissue, hence the importance of brushing the hard palate (Fig. 96).

It should be noted that the brush is used with a full-arm motion, and that a fast but light stroke is essential to secure the desired results.

Number of Daily Brushings.—Some dentists advise their patients to brush their teeth before retiring; some, night

and morning, and the patient who followed this last rule thought himself virtuous indeed. The matter of brushing is purely educational, and resolves itself into a habit. Time can always be found for any habit—it is merely a question of what habits are acquired.

After each meal a certain amount of food is retained on the surfaces of the teeth. In less than an hour's time this food begins to decompose. If the teeth are brushed only at night and in the morning before breakfast remnants of the breakfast remain on the teeth until bedtime, joined through the day by those of lunch and dinner.

There can be no argument in favor of allowing decomposing food to remain undisturbed in the mouth all day. The benefits of cleanliness to mouth health, as well as to general health, should be impressed upon all patients.

For ideal care, then, the mouth should be brushed with clear water as part of the morning toilet. This brushing removes the mucus which collects on the surfaces of the teeth and gums overnight. The necessity for the removal of food débris makes it desirable to thoroughly clean the mouth with a brush and dentifrice after each meal. This means four brushings a day. Whenever it is possible for the patient to follow such a rule the dentist should advise this ideal care.

All children should be taught the habit, as there can be no greater insurance for health than a mouth free from food débris. In the case of many adults, the demands upon the time are so great that the habit of mouth-cleansing must be made to fit in with many other duties. In such instances it becomes a problem for each individual to solve, but all such patients should be instructed that it is of the utmost importance to have the mouth thoroughly clean at bedtime.

In designing this method of brushing an effort was made to simplify and expedite the process of mouth-cleaning and tissue stimulation, in the realization that the care of the mouth is but one of the many phases of personal hygiene which intelligent people desire to incorporate in the daily routine. The circular stroke is especially economical in time expended, since it effects a rapid but efficient cleansing and stimulation to the buccal and labial surfaces of the teeth and gums of both upper and lower jaws *at the same time*. It requires but *two minutes* of this brushing to effectively cover all parts of the mouth, with the exception of the middle third of the approximal surfaces of the teeth. The bristles of the brush cannot be forced between the teeth with safety or used to efficiently clean the interproximal surfaces.

Dentifrices.—The most important ingredient in a dentifrice is soap. Next, a mild abrasive, such as a fine grade of light weight precipitated chalk. The rest of the formula is of but little value and is used chiefly to disguise the soap and impart a pleasant taste. The removal of grease is a chemical action, and soap is essential for thoroughly cleaning the teeth. If fat is rubbed on the hands or on a slab of glass it will be difficult to remove it with clear water and a brush. Although with considerable effort it may be done, soap will remove it much more quickly. A fine grade of powdered Castile soap is best, but it is seldom found in the preparations on the market, as it does not give sufficient lather to suit either manufacturer or purchaser. The most harmful constituent in a dentifrice is a gritty coarse grade of chalk. The teeth should be cleaned, not scoured, and the daily use of a gritty dentifrice will eventually cause abrasion of the thin enamel surfaces at the necks of the teeth. In fact some preparations contain pumice, some

powdered silex, and in one foreign production powdered oyster shells were found. The grit may be readily detected by placing some of the paste or powder between the teeth and biting on it. Finer tests may be made by putting it between two glass surfaces, rubbing them together and examining them with a magnifying glass.

A mild abrasive is helpful as a detergent in the removal of the slippery film of mucin and viscid accretions on the surfaces of the teeth. Its daily use is harmless, providing the grit is fairly soluble and not coarse. When one computes the number of occlusions that take place daily between the masticating surfaces of the teeth during the three meals, and notes what little wear of the enamel cusps is exhibited at thirty-five or forty years of age, it may be concluded that the use of of a fine grade of precipitated chalk as a base for a dentifrice is not a serious menace to the enamel tissue. There is but little choice between powder and paste, as regards efficiency. Powder has to be worked into a paste-like condition in the mouth with the brush, while paste quickly spreads itself over the mouth for immediate action. The majority of people find the paste much pleasanter to use. The difference in the formulæ of the two preparations consists in leaving out the saccharin in the powder and mixing the powders and oils with glycerin to form paste.

A simple, cheap and effective powder may be made from the following formula, suggested by Dr. Hermann Prinz:

Light English precipitated chalk	94 parts
Powdered Castile soap	5 parts
Saccharin	$\frac{1}{20}$ part
Flavoring	1 "

Approximated in weight the formula reads:

Light English precipitated chalk	6 lbs.
Powdered Castile soap	5 oz.
Saccharin	25 gr.
Flavoring	1 fl.oz.

The fluidounce of the flavoring consists of the following:

Oil of peppermint	56 parts
Oil of eucalyptus	16 "
Oil of lemon	10 "
Oil of anise	5 "
Methyl salicylate	12 "

Drugs or medicaments have no place in a dentifrice. The claim that any dentifrice possesses curative properties is made on a purely commercial basis to beguile the public into purchasing a specific preparation. It should be remembered that a dentifrice is valuable only as a cleansing and polishing agent.

The brush should be very wet when the powder is placed upon it, and care should be taken not to inhale when introducing the brush into the mouth.

A properly prepared tooth paste is a much pleasanter toilet article to use and, as there are some on the market quite effective and harmless, one of these may be recommended to patients.

Each tooth has five surfaces. Three of these can be cleaned with the brush, but the two approximal surfaces cannot be reached with it. In other words, three-fifths of the surfaces of the teeth can be cleaned with the toothbrush, but not the remaining two-fifths. It should then be apparent that if all the food is to be cleaned off all the surfaces of all the teeth additional means of so doing must be employed. Up to the present time nothing is known that will accomplish this more efficiently and harmlessly than the use of floss silk.

Floss Silk.— If the floss silk is skilfully and frequently used, the approximal surfaces may be kept quite free from dental caries. To induce patients to use the floss silk with regularity is a task, but by being persistent in requesting and

logical in the reason for its use they may be made gradually to acquire the floss habit. To insure the proper use of the floss the fillings in the approximal surfaces should be smooth and polished, with just sufficient pressure at the contact points to allow the floss to snap through without too much effort in forcing it. The patient should be instructed not to allow the floss to snap through on the gum tissue hard

FIG. 97.

enough to wound it. There is but little danger of this after practice, especially when the gums have become hard and tough from brushing. A reasonably small-sized waxed floss is the best to use. For adults the piece should be 14 or 15 inches in length. The end of the floss is taken between the thumb and first finger of the left hand and two wraps made around the end of the first finger, and this act repeated with the other end of the floss on the right

forefinger. The floss is now held securely and will permit the ends of the two thumbs or the two second fingers or a combination of a thumb of one hand and a second finger of the other to guide the silk into its position in the mouth and force it between the teeth. Fig. 97 shows adaptation

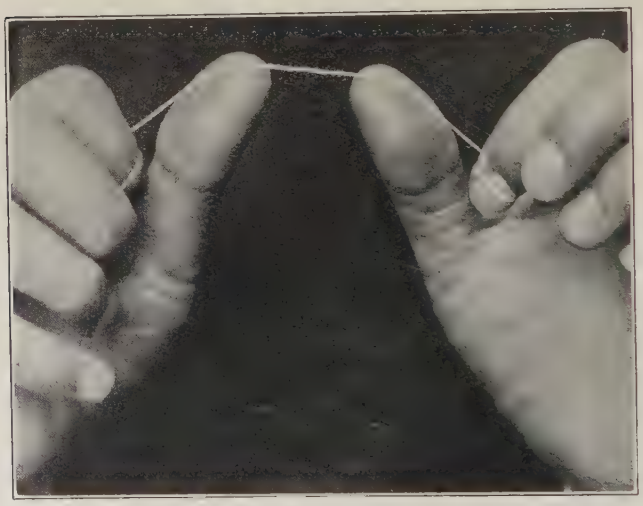


Fig. 98.

of floss for right upper teeth. Fig. 98 shows adaptation for left upper teeth. Fig. 99 shows adaptation for all the lower teeth. After the floss has passed through the contact point it should be rubbed back and forth against both approximal surfaces to polish them mechanically. In withdrawing the floss, if the end held opposite the lingual surface is brought over on the buccal surface and the silk is pulled through the contact point in the form of a loop, it will be more effective in polishing or cleaning these surfaces than if merely snapped out (Figs. 100 and 101). The floss will not,

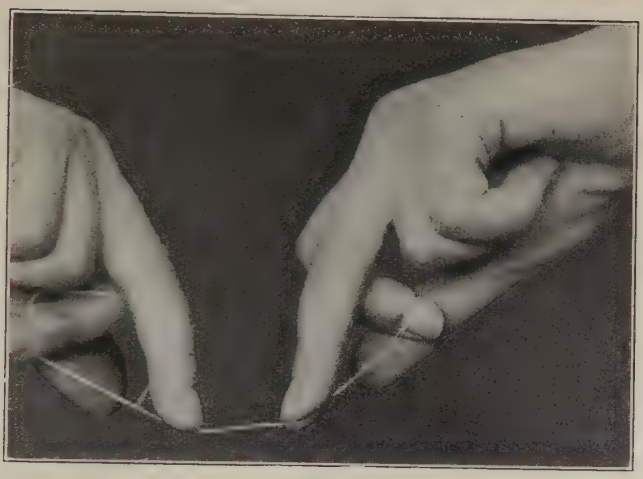


FIG. 99.

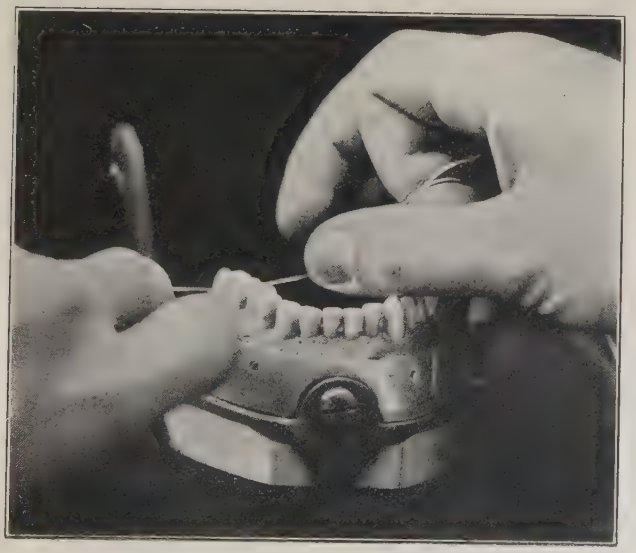


FIG. 100.

however, thoroughly remove all the food between the teeth, therefore we must have recourse to a mouth wash.

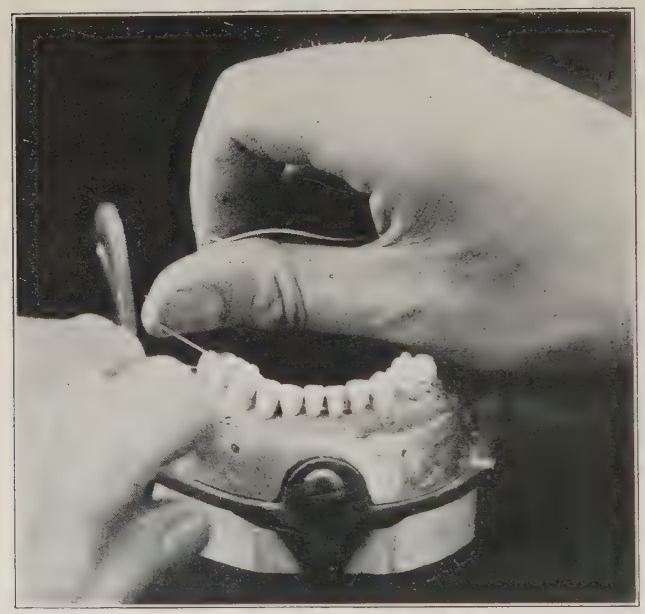


Fig. 101.

Lime Water Mouth-wash.—Many people wish to use a mouth-wash, and it is a desirable adjunct to aid in the mouth toilet, provided a harmless formula is used. The prevailing impression that certain commercial preparations have curative properties is as incorrect as the similar conception in regard to dentifrices, and the general use of medicated washes as a part of daily mouth care should be discouraged. The usefulness of a mouth-wash may be tested by its efficiency only so far as it aids in the prevention of dental caries. This may be accomplished in two ways: (1) Mechanically; when a quantity of liquid is rinsed vigor-

ously about the mouth it mechanically assists in the removal of food, especially any particles that have been loosened from the approximal surfaces by the floss, but not carried away; in this connection it can be particularly helpful if the teeth are irregular, and consequently more difficult to clean on all surfaces, or when orthodontic appliances are in use. (2) Chemically; as a solvent for the mucin on the inaccessible surfaces of the teeth, and as an agent to increase the intraoral calcium content.

A saturated solution of calcium oxide, commonly known as lime water, has been advocated by the author for many years, because it has unquestionably accomplished the desired results, and is so inexpensive and simple to prepare that it is available to anyone.

Some fresh coarse lime, such as is used in making rough plaster, may be secured from a paint store or from a mason. The refined product found in the drug stores apparently does not have the same effect. The refining process robs it of some of its beneficial properties. The lime should be cream-white in color. The lumps are broken up into coarse powder and a half-cupful put into a quart bottle. The bottle should be nearly filled with cold water, shaken vigorously and set aside for three or four hours to allow the lime to settle. The bottle should not be tightly corked. Then as much as possible of the clear water should be poured off, for this contains the washings of the lime. It will be found impossible to pour off all the water without losing some of the lime, but by pouring slowly nearly two-thirds may be drawn off. The bottle can then be filled with cold water and shaken thoroughly, when, after it has settled again, it will be ready for use. A bottle of smaller size should be procured; one holding 10 or 12 ounces, and filled with the clear water from the large bottle. This smaller bottle will

be more convenient to use at the bowl. The large bottle can be again filled with cold water, shaken thoroughly and set aside to be used as needed (Fig. 102). This operation may be repeated over and over again, for the original half-cupful of lime will make 5 or 6 quarts of lime water. If the first use of the wash proves that it is a little strong it can be diluted in the small bottle. With new patients and those having tender gums it may have to be diluted, but as soon

Fig. 102.

as possible it should be used undiluted. When taken into the mouth it should be forced back and forth vigorously between the teeth with the tongue and cheeks and the rinsing continued until it breaks into a foam. Not that there is any particular beneficent action to the foaming, but if it is worked through the teeth long enough to make the foam it will have been in contact with the surfaces of the teeth long enough to have a disorganizing action on the mucin

and plaques. Afterward the mouth should be thoroughly rinsed with warm water to take away the taste of the lime water. It is the unpleasant taste of the lime that makes it difficult to induce the patients to use it at the start, but after a short time the cleansing effect is so pleasing that they soon forget about the taste. It may be flavored with saccharin or any flavoring material, but this will hardly be found necessary. The lime water should be used after the brushing and flossing.

A mouth-wash in liquid form is frequently not convenient to use, especially when traveling. Dr. Hermann Prinz suggests the following formula for making a mouth-wash powder.

POWDER FOR MAKING MOUTH-WASH.

Saccharin	12 gr.
Menthol	15 "
Lime (calcium oxide)	150 "
Shaker salt	1 pound

The first two ingredients have to be thoroughly triturated in the mortar, so as to obtain a fine powder. The lime is added, thoroughly mixed with it and finally the salt is added. The mixed powder should be passed through a *coarse* sieve so as to form a uniform mixture.

A small shaker or bottle of the powder could be conveniently carried. A quarter of a teaspoonful is dissolved in half a glassful of warm water, each time the wash is needed.

In the author's practice all patients are supplied with a pamphlet containing printed instructions, with illustrations, for the home care of the mouth. The pamphlet is to aid in following the wash-bowl instructions given in the office.

CARE OF ARTIFICIAL DENTURES.

It is possible for an artificial denture of even the most hygienic construction to prove a menace to the wearer unless definite instruction is given in the daily care of the appliance. The following outline of the home care of artificial dentures is suggested to supplement the instructions given in the office, and a printed copy could be supplied with every removable appliance.

Instructions for the Home Care of Artificial Dentures.— 1. Remove the appliance after each meal, and scrub with a stiff brush, soap and water.

2. Clasps, or other attachments, must be rubbed vigorously once a day with orange-wood stick and pumice, especially the surface in contact with the natural teeth.

3. After the brushing and flossing of the natural teeth, the tooth surface upon which clasp or other attachment rests must be rubbed vigorously with flat floss or linen tape.

4. Any appliance should always be removed at night to rest the tissues, prevent undue absorption and decay of the natural teeth.

5. Every two or three months the appliance should be cleaned at a dental office to retain the smooth highly polished surface.

Special Care of Vulcanite Dentures.— 1. Hot water is injurious to vulcanite; use warm water, soap and brush for cleansing.

2. Vulcanite is slightly porous and absorbs food débris, which gives a sour odor to the plate. To avoid this condition the plate should be placed once a week in a glass of water to which a half teaspoonful of aqua ammonia has been added. When the plate has been soaked in this solution for an hour, scrub with soap and water.

CHAPTER V.

PREVENTION THROUGH PUBLIC EDUCATION.

It has been previously stated that there are two distinct methods of prevention—the one which strives to recognize and correct the incipient stages of disease, the other, which may be termed true prevention, being based on the efforts to raise the intelligence of individuals and communities through educational measures regarding the laws of health. The first method is well developed and is practised in a large measure by both the medical and dental professions and is highly essential. However, when the practice of preventive medicine or dentistry is so closely associated with disease that is already present, there is a tendency to forget that scarcely one of the methods used is truly preventive. The fundamental truth to keep constantly in mind is the inherent ability of the body cells under normal conditions, to build perfect structures and to establish and maintain natural immunity to disease. The following diagram is an attempt to show how little is being done in the field of true prevention to keep people well in comparison with curative efforts.

Fig. 103 is intended to summarize the present-day efforts expended upon the prevention of disease and the cure of disease. Above the health line are shown the main efforts for disease prevention. The tube is to represent the path of those who become ill, chiefly from preventable diseases, and entering from the health area. Those who strike the

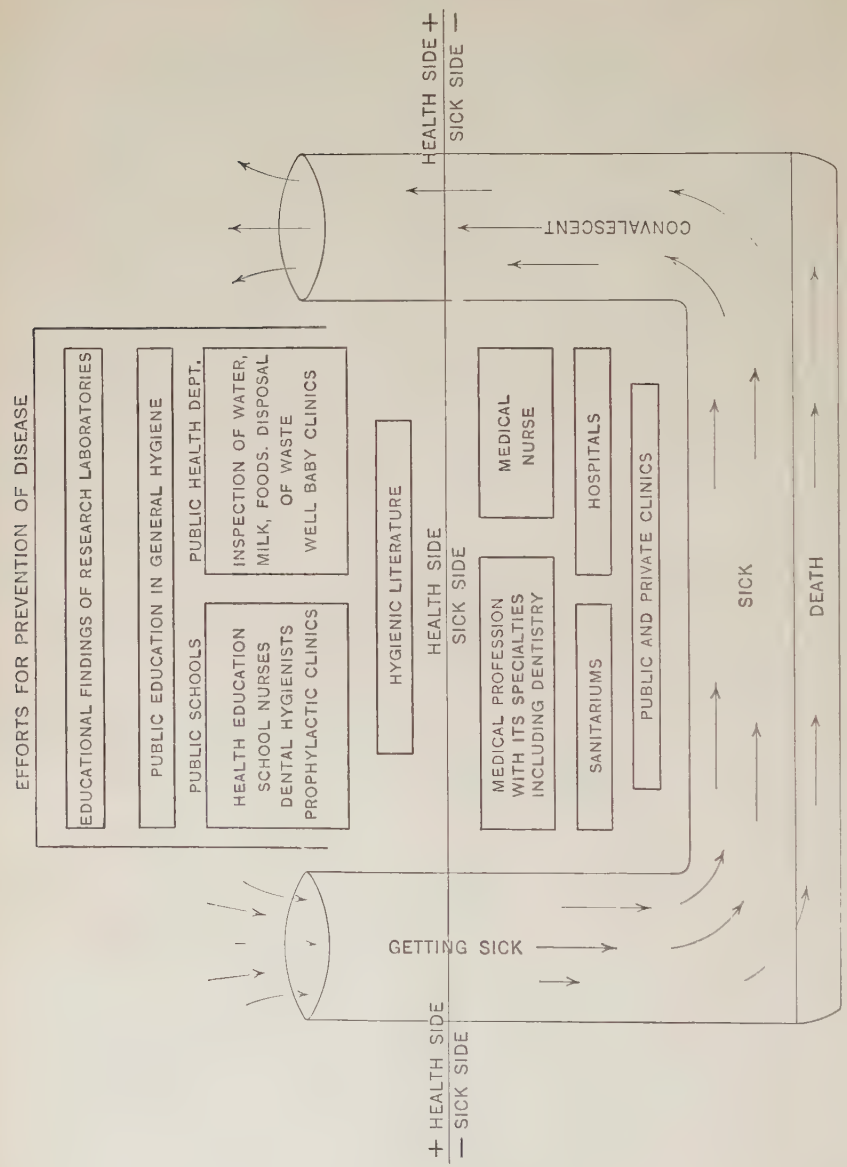

EFFORTS FOR PREVENTION OF DISEASE
EDUCATIONAL FINDINGS OF RESEARCH LABORATORIES
PUBLIC EDUCATION IN GENERAL HYGIENE
PUBLIC SCHOOLS
HEALTH EDUCATION
SCHOOL NURSES
DENTAL HYGIENISTS
PROPHYLACTIC CLINICS
PUBLIC HEALTH DEPT.
INSPECTION OF WATER, MILK, FOODS. DISPOSAL OF WASTE
WELL BABY CLINICS
HYGIENIC LITERATURE
HEALTH SIDE
SICK SIDE
MEDICAL PROFESSION WITH ITS SPECIALTIES INCLUDING DENTISTRY
SANITARIUMS
MEDICAL NURSE
HOSPITALS
PUBLIC AND PRIVATE CLINICS
HEALTH SIDE +
SICK SIDE −
CONVALESCENT
SICK
DEATH
GETTING SICK
+ HEALTH SIDE
− SICK SIDE

FIG. 103.

bottom of the tube die; the others passing through the convalescent stage to emerge again into the health area.

Below the sick line are shown the main efforts for the cure of disease. The medical profession, with all of its various specialties including dentistry, the great corps of medical nurses, the sanitariums and hospitals and the public and private clinics are concentrating chiefly upon the sick. Hundreds of millions of dollars in public and private funds are expended to restore the sick to health, but only a relatively small portion of this amount is spent to maintain the health of well people, even though it is definitely known that the most common physical defects and illnesses are preventable.

Although it will be noted that there are a considerable number of activities listed on the health side, yet in fact not many of these are in general effect throughout the country. For instance, very few public school systems have a well-defined health program, or utilize to sufficient extent the services of various health workers.

The dental hygienist is a notable contribution from dentistry, especially when employed in the public schools to establish clean mouths and sound teeth, and to teach dietetics and health habits. The public schools present a tremendous field for preventive efforts, one where physical defects can be eliminated, or prevented in early childhood, and the coming generation taught the laws of health and of disease prevention. Every dollar spent for prevention on the plus side of the health line means a saving of fifty dollars on the minus side, in addition to the continuance of the efficiency and happiness of the individual.

Most of the public charity dispensed at the present time is among the sick and the physically disabled. Like the treatment of disease, it is merely a palliative measure, and little effort is made to reach the source. People who

have good health and an education are rarely objects of charity. The possibility of maintaining a healthy body and a keen mind during adult life is greatly diminished because the majority of children of school age have physical defects and growth handicaps. In later years these warp the mentality and lower the physical efficiency, which permits of easy discouragement or of actual inability to maintain an independent existence. The main solution to the problem of charities is, therefore, the same as that for disease, namely, physical education and supervision, with the correction of remediable defects, in conjunction with the mental training provided for all children of school age. It is not the intention to in any way belittle the efforts being made to aid the sick and needy, nor should such efforts be decreased. The vital point is that we have not commenced to cover the possibilities of true prevention, especially if concentrated on children in the public schools.

The Cell.—In order to appreciate the value of prevention through education it is necessary to think of individuals as aggregates of millions of cells, each of which may develop along normal or abnormal lines, according to the influences to which it is subjected.

Nature, in the building of all matter, builds from the unit. Although the atom is the smallest unit, the molecule of the mineral kingdom and the cell of the animal and vegetable kingdoms are the general basis for study. All earthly creations visible to us are formed on this one plan. The trees, the flowers, the grass, the mountains, the beach, the sea—all animal life including man—each is made by the combining of these units, all working with an intelligence and subject to chemical laws far beyond our comprehension.

Why it is that the content of the cell, which is called protoplasm and which appears to be nothing but a jelly-like

mass, has the property of manifesting life and intelligence, is difficult to understand. This substance can be analyzed, and even the proportion of its elements estimated, yet what unseen force imbues it with energy and intelligence, and what becomes of this life-giving power when the cell dies and disintegrates, is not known. Cell action can be studied, and the cell can be supplied with the essentials for growth and development. It is a realized science that in animal life certain factors, properly applied at the proper age, can greatly develop its function and intelligence, the same as in vegetable life, but it cannot be explained. It is known that all manifestation of life and of intelligence is expressed through this matter contained within the cell. The intelligence displayed by the individual cells of the body is the marvel of research workers. Much is yet wrapped in mystery and many years will pass before some of the deep problems of nutrition and the hard fought battles waged against disease will be fully understood.

When the body is abused this abuse is imposed upon millions of intelligent units which do their utmost to offset ignorance and wilful acts by patiently combatting the impositions and trying to repair and correct the damage wrought. In early youth the cells are in abundance, and the supporting structures are but partially formed. In adult life the work of the cell is completed and the intercellular structure is in predominance. The great period for structure building, for the guidance of proper cell development, and a high resistance to disease by applying scientific factors to properly influence this result, is from infancy to twelve years of age.

As a spider spins his web, so do these minute cells create tissue to aid them in their work. The individual reflects the composite texture and make-up of the aggregate cells of the body, and the period for moulding, refining and advancing this cell development to its highest plane is in early youth.

Factors for Normal Cell Life.—There are a number of factors for normal development, but a few stand out conspicuously. The first is *fresh air*. One can live for a considerable period of time without water and food, but one cannot exist for five minutes without oxygen. All cell life is chiefly maintained by a chemical process of oxidation, and a constant supply of fresh air, both day and night, is the first essential for health. Although much has been accomplished through education to secure proper ventilation of the living and working quarters in this country, there are still countless numbers of people who do not know the necessity for fresh air constantly in circulation, especially in sleeping rooms.

The second essential for normal development is a proper food supply. The character of the food determines the character of the cell and of the individual. *What is eaten*, *how much is eaten* and the *manner* in which it is eaten are some of the chief factors for health balance, and should be a study for all dentists.

Next comes *cleanliness*, for if cells are to maintain a high resistance to disease, clean environment, clean food, clean water, clean bodies and thorough removal of waste products are necessary. All efforts which tend to lessen the numbers of bacteria in our daily contacts are aids to normal growth and safeguards against disease.

Sufficient sleep and rest, and exercise, especially in the open air and sunshine, are health factors of recognized necessity.

Mental attitude is another powerful factor that should be well-understood. Self-control, optimism, a mental poise that can discard fear and worry, that holds an even balance under varying circumstances and that radiates good cheer and kindness with their health-giving influences to every

cell of the body, are elixirs unequalled in the building of the character, as well as in regulating the balance and functioning of the entire system.

Although heredity, too, plays a strong part, yet the health factors named can greatly modify the inherited disposition of the cells, if wisely applied.

If man lived what is termed a "natural" existence, an outdoor and primitive life with simple coarse foods and work or exercise in the open air which developed the animal side, there would be but little need of the physician or the dentist. But this so-called natural existence is not possible to 70 per cent of the people of the present day. Their very existence depends upon their work or artificial life in the cities. Therefore this health problem of city life must be solved. The factors which are productive of health in the animal life must be substituted artificially. The passing generation cries that the children are being brought up too much by the teaching of science and the book, instead of in the good old-fashioned way of letting Nature look after them. Take, for example, the wild rose of the field that depends upon sunshine and shade, warmth and moisture and proper soil for its growth. Nature does not and cannot always supply these in sufficient degree and in proper balance, and, although the flower is beautiful, it cannot be compared with the beautiful rose that the horticulturist can grow when these essentials are scientifically and artificially supplied. In the hot-house the correct temperature can be maintained, moisture in sufficient quantity supplied, sunshine and shade regulated at will and fertilizers essential to stimulate growth be added to the soil The work of Burbank in scientifically handling vegetable life is well known, as well as our modern methods of agriculture and fruit-raising. The wonderful feats of the horse—hurdling, running and

trotting—are due in great measure to the scientific training by man. Many instances can be given in which Nature far excels her natural state of environment if the essentials she needs are supplied artificially and scientifically in sufficient abundance.

And so it is in the growth and development of the child. If the proper factors for health can be properly applied it is possible to grow children so far superior to those of the present-day average in the public schools, as the American Beauty is superior to the wild rose.

The public schools present the most fruitful field for true prevention, since health education can never be spread farther or more rapidly than through these great institutions of our democracy, where practically every home is represented. It is true that every dentist and physician could do much toward spreading the knowledge of health measures in his daily practice, even though confined almost entirely to those in need of curative treatment. A comparatively small group of educated people have secured the knowledge and treatment of disease, and also the knowledge of its prevention, but even the favored few who can afford the services of dentists, physicians and the various specialists, are not taught the preventive measures which these professional people know so well. Neither the medical nor dental professions have succeeded in spreading to any great extent the laws of health and of disease prevention.

The knowledge of hygiene and all methods of disease prevention, which are the result of years of scientific research, should not be considered the exclusive property of the medical, dental or any other scientific profession which has not the greatest opportunity to spread health education for the benefit of this and succeeding generations.

Experience has shown that health education can be carried

out most efficiently by specially trained and educated teachers who are not closely associated with the treatment of disease.

The Dental Hygienist Movement.—It was for this type of service that the dental hygienist was created. It had long been realized that the dental profession was unable to cope with the universal need for mouth hygiene, the number of dentists available at any one time being always insufficient to supply even the need for good operative dentistry. With dental disease and resultant systemic infections almost universal maladies, trained workers for maintaining mouth health are essential. The dental hygienist was created from the realization that mouth hygiene was a necessity, that the average dental practitioner could not give sufficient time to it, and that the tooth-brush alone would never produce it. She is the trained worker to spread popular health education and dental prophylactic service to aid in the prevention of dental disease. Fortunately it does not require a graduate dentist to perform a prophylactic treatment, or to teach mouth-brushing, food habits and general hygiene. The present need of the dental profession, in solving the public health problem of mouth hygiene, is an immense corps of women workers, educated and trained as dental hygienists, and therefore competent to enter public schools, dental offices, infirmaries, public clinics, sanatoriums, factories and other private corporations, to care for the mouths of the millions who need this educational service.

The first course for dental hygienists was inaugurated in the office of the author in Bridgeport, Conn., in 1913. The main purpose of training these specialists was to demonstrate the value of education and preventive treatments when applied to the mouths of school children. The class also included young women who entered practice in private offices, and now after eleven years of growth, the preventive

work of dental hygienists in private dental offices is generally accepted to be of exceeding value to dentists and their patients.

In 1916 and 1917 additional courses were given, and the dental hygienists were utilized in public schools, hospitals, industrial and municipal clinics and private offices. In the comparatively short period since the inauguration of courses for dental hygienists, twenty-six states have amended the dental laws to legalize the practice of these women, and there are ten training courses in connection with dental colleges or infirmaries.

Private Practice Service.—The dentist who is first establishing himself in private practice is frequently able to devote the necessary time to the prophylactic treatment for his patients, and instruction in mouth care and dietetics. It is essential that a dentist be skilled in his ability to render these services, and it undoubtedly adds to the importance of preventive service in the mind of the patient to have the dentist personally evidence interest and enthusiasm in the matter of dental hygiene. At such time when a dentist finds that he is compelled by the pressure of operative dentistry to neglect the prophylactic treatment and instructions, it is desirable to continue this important service through the dental hygienist. A well-trained dental hygienist can be of inestimable value in carrying out the educational and prophylactic service in a private practice, and through her frequent inspection of the patients' mouths may be utilized to coöperate with the dentist in all measures of disease prevention. With the realization that preventive measures applied to the mouths of children are most productive of the desired results, the work of the dental hygienist may be especially effective in securing the interest and confidence of these important patients.

The services of a dental hygienist in private practice should include:

1. The prophylactic treatments.
2. Recording for the dentist all defects noted during treatment.
3. Repeated instruction of patients in a system of daily mouth care.
4. Dietetic advice, especially for expectant mothers and children.
5. Information concerning various phases of hygiene and dental education, such as prevention of pernicious habits in children, necessity for frequent examination of mouths, etc.

In addition to these educational and preventive services, the hygienist frequently assists in roentgenography, which is an important phase of the prophylactic routine.

Public Service.—Hospitals and Sanatoriums.—The relation of pathological mouth conditions to systemic disease is now so definitely known that hospitals and sanatoriums have established dental divisions for the roentgenographing, diagnosing and sanitation of the mouths of patients. The sanitation of the mouth necessitates the services of dental hygienists who can operate at the bedside, if necessary. Where such a procedure is being followed in hospitals and sanatoriums the most gratifying results are obtained, and there is undoubtedly an educational value to this type of service which is far-reaching.

Industrial Dental Clinics.—One of the most important branches of dental hygiene is that which may be provided for the great working classes who need sound teeth for good health, but for whom until recently there has been no provision in dentistry. These are the people who suffer from systemic disturbances due to diseased teeth, yet scientific dental operations are out of their reach. Fortunately,

preventive dentistry and education for mouth health can be placed within the reach of all. The economic value of educational, preventive and diagnostic dental clinics in connection with large industries has been shown to be the most fruitful form of welfare work for employees. The dental department of the Metropolitan Life Insurance Co., is a notable example of the successful utilization of dental hygienists as a part of the preventive dental service offered to its employees.

Public Schools.—It is now universally conceded that the most conspicuous physical defect of the school child is the unhygienic condition of his mouth. The reports of the medical inspectors in the public schools, who have made but a glancing examination of the mouths of school children, show that decayed teeth outrank all other physical defects combined. Careful dental examinations reveal the fact that it is difficult to find two school children out of a hundred with a sound set of teeth, and that the fifth-grade children will average seven cavities per child. How to overcome this deplorable condition, how to establish clean mouths, sound teeth and healthy gums this is one of the most important public health problems facing the medical and dental professions. The school dental clinic is, of course, the answer. But ideas differ regarding the service that such a clinic should render. The dental clinic which attempts to fill the teeth of school children usually fails in its purpose of helping the situation materially, because it is never possible to cope with the enormous number of children needing dental attention, and such a clinic resolves itself into a charity.

There are those who argue that a large number of parents can afford to pay for dental service, and that the school dental clinics need only be conducted for poor children. Such an argument is most un-American. When city officials

appropriate city money for a dental clinic in the public schools it is no more right to use that money to provide dental service for one class of children and exclude another than it would be to provide text-books or pencils for the poor children attending the public schools and not for the others. We have no public institution more sacred to the American doctrine that all are free and equal than the public school system, and the true Americanism of this system is violated when a charity is introduced into it. A dental clinic carried on in the schools, selecting here and there a child to receive free dental service can be classed as nothing else than a charity, and the child is pauperized. It cannot be denied that there are thousands of children who are sadly in need of dental service, and whose parents can never afford to provide it, and it seems inhuman in this twentieth century to allow the poorer class of children to suffer as they do from toothache; but such relief cannot be dispensed through the public schools any more than shoes and clothing can be supplied to the needy in this way. The solution to this situation lies only in the establishment of central relief and repair clinics for the poor, either by private or municipal support, where all the work is acknowledged as a charity and accepted as such.

The problem of filling the teeth of *all* the children in any large school system cannot be considered for the following reasons: (1) City officials do not, as yet, sufficiently appreciate the immense importance of sound teeth to good health to be willing to appropriate the large sum of money that it would require; (2) unless followed by a definite system of prophylaxis, such work would be merely palliative, and in a few years the same children would again be affected with dental caries while an equal number of new children were still uncared for; (3) until parents and children are educated

to the importance of caring for the mouth, the making of such operative work compulsory would cause much trouble; (4) most important is that, even if funds were available, the task would be hopeless, because it would not stop the flood at its source, but merely repair the damages after they had occurred.

In Bridgeport, Conn., a plan to demonstrate what might be accomplished by applying the known means of prevention of dental caries to large groups of children was inaugurated in 1914. This was the inspiration for the original training course for dental hygienists, to provide a corps to carry out the first dental service in the public schools along educational and preventive lines.

The working plan for the service was based on the following established facts found from preventive efforts in private practice: (1) That the frequent removal of plaques and accretions from all the surfaces of all the teeth by means of hand polishers is the most efficient means, aside from a correct diet, for the prevention of dental caries; (2) that the faithful use, daily, of the tooth-brush, floss silk and a mouth-wash (such as lime water prepared from coarse calcium oxide) is the best known means for the thorough removal of food débris and the dissolution of mucin; (3) that nearly all microörganisms in the human mouth are harmless if deprived of a pabulum, such as food débris, upon which to feed, develop and multiply.

This furnished the basis for the operative and educational program which was divided into four distinct parts: (1) The prophylactic treatments, or actual cleaning and polishing of the children's teeth, and chart examination of the mouths; this service was limited to first- and second-grade children originally, but was soon extended to include the first five grades, or about 20,000 children yearly. (2) Tooth-

brush drills, and class-room talks on dietetics, mouth hygiene and later general hygiene. (3) Stereopticon lectures for pupils in the higher grades not included in the prophylactic program. (4) Educational work in the homes by means of special literature for parents and older children. All the work was carried on in the school buildings, the equipment being portable and adapted to almost any location. Every child in the grades worked in received the same treatment regardless of the financial status of the parents. In short, this preventive system was incorporated as part of the school curriculum. Some parents objected, believing the work was a charity, but with an understanding of the program the objections were soon withdrawn.

The demonstration was planned on a five-year basis, so that a large group of the same children, progressing from the first through the fifth grades could follow the dental hygiene program over a five-year period. The mouths of these children were to be used for statistical purposes and compared with those of the fifth-grade control class, which had had no mouth hygiene. The results, which have frequently been published in detail, showed that the incidence of dental caries in the permanent teeth of fifth-grade statistical children was reduced 33.9 per cent during the first five-year period (1914–1919).

The reduction shown is principally the result of education and preventive treatments, since it was not possible to finance a central repair clinic for these children. In 1915–1916 three women dentists were employed to operate in the schools, devoting their time exclusively to filling small cavities in the six-year molars of first- and second-grade children. The result of safeguarding these important teeth is shown by the following:

In 1915 the fifth-grade children had lost 15.1 per cent of the six-year molars.

In 1920 the fifth-grade statistical children had lost 7 per cent of the six-year molars.

These same statistical children of 1920 showed a reduction of 49.6 per cent in the incidence of dental caries in permanent teeth, when compared with the control class.

During 1921 the children had access for the first time to a municipal clinic for filling permanent teeth, and as a result the percentage of reduction in dental caries rose to 69.3 per cent.

In the fall of 1921 the Board of Education in Bridgeport, Conn., voted to require a definite physical standard from every school child, and after conferences with the Department of Health, adopted the following resolution:

"Whereas, the results in the draft of the young men between the ages of twenty-one and thirty-one years in the World War necessitated the rejection of approximately 1 out of every 4 such young men by reason of physical defects, and,

"Whereas, we have laid the foundation in our public schools of a course of civics and health to correct for the future generation such deplorable results, and

"Whereas, the State of Connecticut has shown its intent to produce a citizenship which shall be sufficiently strong in health to meet its demands, through the enactment of provision of Chapter XXI, Laws Relating to Schools, and

"Whereas, the city of Bridgeport, Conn., has made provisions in the various clinics housed in its Welfare Building to meet the city's responsibility in this fundamental matter of health.

"*Be it Resolved*, that the Board of Education in order to put into effect the full requirement of the State Statute with reference to health as stated in Chapter XXI, para-

graphs 306 and 307, do enact that the course in Physical Education which seeks to provide proper physical development through the use of calisthenics, athletics and supervised games as is outlined below or may be outlined by the Board of Education, be made basal for promotion from one grade to another, as follows:

"I. *Program of Physical Training Activities.*—This program to include school-room and playground supervised games, calisthenic drills and other large muscle activities and to culminate in a promotional mark.

1. 50- and 100-yard dash.
2. Standing broad jump.
3. Basket-ball far throw.

"II. *Program for Right and Efficient Living.*—This is to be carried through by the classroom teacher with the aim of teaching hygiene, of making health attractive and in fastening wholesome health habits covering at least the following:

1. Proper use of the handkerchief.
2. Emphasis upon cleanliness and its value.
3. Proper use of tooth-brush, hair- and shoe-brush, etc.
4. Bathing, with special emphasis upon shower baths.
5. Breathing exercises for posture and lung development before open window.
6. Rest and short relaxation periods.
7. Correct methods of eating.
8. Individual drinking cups, pencils, towels, combs, tooth-brushes.
9. Proper use of voice.
10. Proper use of eyes.
11. Necessity for daily exercises in open air.
12. Cheerfulness and the game spirit.
13. Liberal water-drinking.
14. Ventilation—school and home.

"*Be it Further Resolved,* that in coöperation with the Board of Health that the following physical defects and growth handicaps be corrected or be in the process of correction as requisite for promotion.

"III. *Program for Controlling Growth Handicaps.*

(*a*) All remediable defects of hearing.

(*b*) All remediable defects of vision.

(*c*) Defects of the nose and throat.

(*d*) Diseases of the skin.

"IV. *Dental Standards for Advancement.*

(*a*) Certification from the dental hygienist that there are no cavities in the permanent teeth.

(*b*) That the pupil has demonstrated effectively the use of the tooth-brush to remove food débris and to keep the gums in a state of health.

(*c*) That the teeth and gums are in a clean and healthful condition.

"This entire program for promotion from grade 5 to grade 6 shall be effective beginning June, 1921, and shall be extended as the Board of Health is able to cope with the problem. Any pupil of the fifth grade who has been in our school system less than half a year is exempt from meeting these requirements."

It was possible to enforce this program in Bridgeport, Conn., because provision has been made in a municipal dispensary to care for all remediable defects for children whose parents cannot afford the services of private practitioners. A minimum charge is made for those who are able to pay.

It cannot be denied that the ideal time of attacking the problem of physical defects is in the prenatal and preschool periods. Unfortunately, however, except for the relatively small numbers that can be reached in clinics, direct contact

during the prenatal and preschool periods is exceedingly difficult. In fact, the only place that every family is represented and can be approached is in the public schools. The inauguration of compulsory health education in the schools will do more to *permanently* eliminate remediable physical defects for the great *mass* of children than all other measures combined, even though it requires a generation to accomplish results.

The state must assume responsibility for the health as well as the education of its children, and there is no more effective way of bringing parents and children to a realization of the value of a sound body than to require a definite physical standard from every school child—thereby applying retardation to the physically defective, as well as to the mentally deficient child. When a child's progress in school is equally dependent upon his physical as on his mental ability, the report showing defective ears, eyes or teeth will not be regarded lightly by either parent or child.

As a result of the compulsory ruling, it was no longer necessary to compile the records of statistical children, since all children were placed under compulsory requirements for promotion.

In 1914, at the beginning of the dental hygiene service, one of the discouraging problems confronted was the very unsanitary condition of the mouths of the youngest children who had just entered school. An excerpt from an early report explains the situation briefly:

"The first year (1914) the total number of children examined and treated in the first and second grades was 6763. On the first examination less than 10 per cent were brushing their teeth daily. About 30 per cent claimed that they brushed their teeth occasionally, while 60 per cent were frank enough to state that they did not own a tooth-brush. Ten

per cent of the children were found to have fistulæ, showing the outlets of abscesses from the roots of devitalized teeth, and they averaged 7 cavities per child. It was shocking to find the mouths of these children, ranging from five to seven years of age, in this deplorable condition, and it was appalling to contemplate the conditions that would exist in these mouths if the children grew up without dental hygiene. It presented very interesting material to work with.

"It will take a long period of public education before the mouths of children coming into the first grade will show any degree of improvement. From birth to five years of age they are entirely under the home influence, and are given foods that are conducive to decay, and mouth cleanliness is not compulsory. Slowly, but surely the public school education will seep back into the homes, and with the aid of the elder children and the educational pamphlets distributed for the homes, it is our hope that eventually the mouths of these children will present a much improved condition."

During the ten years of dental hygiene in the schools the effect of the mouth sanitation campaign was felt in the homes and applied to the children of preschool age, as shown from the first examination of the mouths of first-grade pupils in 1924.

The number of first-graders entering school with clean mouths has increased 50 per cent. The number of children who did not use tooth-brushes has decreased from 60 to 9 per cent.

The mouths of the fifth-grade children examined in June, 1924, the end of the tenth year of educational and preventive dental service, present many interesting comparisons with the control class.

The following is a comparative table representing the mouths of nearly 2500 fifth-grade children yearly:

Fifth grade children of	Average cavities per child. Permanent teeth.
1915 (control class)	5.5+
1918	5.2
1919	4.3
1920	3.4
1921	3.0
1922	2.8
1923	2.8
1924	2.5

This examination was not confined to statistical children (those just completing five years of dental hygiene), but included all pupils in the fifth grade, many of whom had attended Bridgeport, Conn., schools but a comparatively short time.

To summarize, the ten-year demonstration accomplished the following (based on statistics compiled from the examination of the permanent teeth of fifth-grade children):

In 1916—35 out of 100 children had lost 1 or more six-year molars.

In 1924—decreased to 18 out of 100 children.

In 1916—12 out of 100 children had six-year molars filled.

In 1924—increased to 60 out of 100 children.

Reduction in dental caries—over 50 per cent.

Throughout the entire grade clean mouths predominate. It is now rare to find a child without a tooth-brush, and practically all have acquired skill in mouth-brushing. Dark-red and congested gums, which were conspicuous in 1914, are now the exception—the large majority of the children possessing healthy gum tissue.

Doubtless the most significant effects cannot be shown by figures, for it is difficult to estimate the influence on retardation, prevention of communicable and infectious diseases, as well as the life-long benefit from early education in general hygiene and dietetics.

The following statement made by E. Everett Cortright, Superintendent of Bridgeport, Conn., Public Schools, presents the viewpoint of an educator regarding the value of mouth hygiene.

"Mouth hygiene as a definite part of the health program of a public-school system can make a contribution to the whole educational program that is very unusual. It has bound up in it certain practical and psychological values which are difficult to find combined anywhere else. First, there is the daily action, with a possibility of the teacher's inspection work holding the pupil to a rigid accomplishment, and this daily practical action persisted in over a period of months or years lays very deep certain habits which are fundamental in the final goal of health teaching. This goal is the individual's personal responsibility for maintaining such a health standard that he shall be vocationally fit, socially acceptable and pathologically immune.

"In addition to the practical action, the psychological inferences from it are even of more importance. The whole question of sanitation—personal and community—gets up into the realm of consciousness through the means of mouth hygiene; the happiness and comfort that flow from the practice in comparison with others not so fortunate carry a convincing argument that no amount of intellectual reasoning can produce; further, the final realization that one holds within *himself* the power of health in a positively protective manner is the final goal, and is reached relatively easily through a serious and correct application of mouth hygiene.

"Because of the psychology which lies behind and which results from a dental hygiene demonstration, the psychological inferences and possibilities reach beyond even that mentioned and may extend into the realm where so certain may one become of himself and his power of control that it

transfers into many concomitant fields and tends to slay the dragon of fear as it operates communitywise in the whole matter of disease.

"Citing here an illustration of Bridgeport, Conn., which ran its public schools all through the epidemic of influenza during the winter of 1918, and was able to do it principally because there has been for three or four years a demonstration of dental hygiene in our public schools. We might have offered to run the schools but nobody would have attended had there not been confidence in the ability of the individual to control his own physical destiny resulting from an active, thorough and complete mouth-hygiene demonstration that had affected all the homes through all the children of the lower grades."

APPENDIX.

SCHEDULE OF LESSONS ON MANIKINS.

POLISHING AND INSTRUMENTATION.

First.
- Teaching the four motions—digital, wrist, rigid-arm and rotary.
- Grasp of polishers.
- Direction of procedure for polishing.
- First three divisions of polishing.

Second.
- Fourth, fifth, sixth, seventh and eighth divisions.

Third.
- Ninth, tenth and eleventh divisions and review of entire labial and buccal surfaces of teeth of both jaws.

Fourth.
- Twelfth, thirteenth, fourteenth and fifteenth divisions.

Fifth.
- Sixteenth and seventeenth divisions and review of entire lingual surfaces of teeth of both jaws.

Sixth.
- Beginning instrumentation.
- First two divisions.

Seventh.
- Third, fourth, fifth, sixth, seventh, eighth and ninth divisions.

Eighth.
- Practical examination on polishing.

Ninth.
- Theoretical (half-hour) examination on polishing.
- Review of instrumentation—removal of varnish and plaster from teeth of lower jaw.
- Divisions ten and eleven.

Tenth.
- Twelfth, thirteenth, fourteenth, fifteenth, sixteenth, seventeenth and eighteenth divisions of instrumentation.

Eleventh.
- Review instrumentation, removal of varnish and plaster from teeth of upper jaw.
- Divisions nineteen and twenty.
- Use of floss for polishing approximal surfaces and use of brush wheel for occlusal surfaces.

Twelfth.
- Examination. Instrumentation (practical) and instrumentation (theoretical).

SYSTEM FOR INSTRUMENTATION.

Division 1. Fig. 46.

Teeth.	Right lower molars, bicuspids, cuspid, lateral and central.
Surface.	Lingual.
Instrument.	No. 18 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger between left lower cuspid and bicuspid on occlusal surface.
Motion.	Wrist or rotary.

Division 2. Figs. 47 and 48.

Teeth.	Left lower central, lateral, cuspid, bicuspids and molars.
Surface.	Lingual.
Instrument.	No. 17 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	End of second finger on cutting edge of right lower cuspid or lateral for left lower central, lateral and cuspid. End of third finger on cutting edge of lower centrals for bicuspids and molars.
Motion.	Rotary.

Division 3. Fig. 49.

Teeth.	Left lower molars, bicuspids and cuspid.
Surface.	Buccal.
Instrument.	No. 18 Darby-Perry.
Fulcrum-point.	End of third finger on labial surface of lower incisors.
Motion.	Wrist or rotary.

Division 4. Figs. 50 and 51.

Teeth.	Lower incisors, right lower cuspid, bicuspids and molars.
Surface.	Labial and buccal.
Instrument.	No. 17 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger between left lower cuspid and bicuspid for lower incisors. Advanced on incisors for cuspid, bicuspids and molars.
Motion.	Rotary.

Division 5. Figs. 52 and 53.

Teeth.	Right lower molars, bicuspids and cuspid.
Surface.	Distal.
Instrument.	No. 13 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger on cutting edge of lower incisors for distal surface of last molar. End of third finger on labial surface of right cuspid and incisors for the balance.
Motion.	Wrist and digital.

Division 6. Similar to Figs. 52 and 53.

Teeth.	Left lower cuspid, bicuspids and molars.
Surface.	Distal.
Instrument.	No. 13 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger on labial surface of lower incisors.
Motion.	Wrist and digital.

Division 7. Similar to Fig. 54.

Teeth.	Right lower molars, bicuspids and cuspid.
Surface.	Mesial.
Instrument.	No. 14 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger on labial surface of right cuspid and incisors.
Motion.	Wrist and digital.

Division 8. Fig. 54.

Teeth.	Left lower cuspid, bicuspids and molars.
Surface.	Mesial.
Instrument.	No. 14 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger on labial surface of lower incisors.
Motion.	Wrist and digital.

Division 9. Fig. 55.

Teeth.	Lower incisors.
Surface.	Approximal.
Instrument.	Nos. 5 and 6 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	Third finger on chin.
Motion.	Wrist.

Division 10. Fig. 56.

Teeth.	Right upper molars, bicuspids, cuspid, lateral and central.
Surface	Lingual.
Instrument.	No. 17 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger on occlusal surface between left lower cuspid and bicuspid.
Motion.	Wrist.

Division 11. Figs. 57 and 58.

Teeth.	Left upper central, lateral, cuspid, bicuspids and molars.
Surface.	Lingual.
Instrument.	No. 18 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	End of second finger on cutting edge of right upper cuspid.
Motion.	Rotary.

Division 12. Fig. 59.

Teeth.	Left upper molars, bicuspids, cuspid, lateral and central.
Surface.	Buccal and labial.
Instrument.	No. 17 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	End of second finger on labial surface of left upper central and lateral and end of third finger on lingual surface of right upper central and lateral, for molars, bicuspids and cuspid. End of third finger on cutting edge of right upper cuspid for lateral and central.
Motion.	Rotary.

Division 13. Fig. 60.

Teeth.	Right upper central, lateral, cuspid, bicuspids and molars.
Surface.	Labial and buccal.
Instrument.	No. 18 Darby-Perry.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third and fourth finger on chin.
Motion.	Rigid-arm and rotary.

Division 14. Fig. 61.

Teeth.	Right upper molars, bicuspids and cuspid.
Surface.	Distal.
Instrument.	No. 13 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger on labial surface of lower incisors.
Motion.	Digital and wrist.

Division 15. Similar to Fig. 61.

Teeth.	Left upper cuspid, bicuspids and molars.
Surface.	Distal.
Instrument.	No. 13 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger on labial surface of lower incisors.
Motion.	Digital and wrist.

Division 16. Similar to Fig. 61.

Teeth.	Right upper molars, bicuspids and cuspid.
Surface.	Mesial.
Instrument.	No. 14 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger on labial surface of lower incisors.
Motion.	Digital and wrist.

Division 17. Similar to Fig. 61.

Teeth.	Left upper cuspid, bicuspids and molars.
Surface.	Mesial.
Instrument.	No. 14 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger on labial surface of lower incisors.
Motion.	Digital and wrist.

Division 18. Similar to Fig. 55.

Teeth.	Upper incisors.
Surface.	Approximal.
Instrument.	Nos. 5 and 6 Smith set.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Wrist and digital.

Division 19. Fig. 62.

Teeth.	Lower.
Surface.	Buccal, labial and lingual.
Instrument.	Sickle-shaped.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger on cutting edge of incisors.
Motion.	Digital. Draw stroke.

Division 20. Fig. 63.

Teeth.	Upper.
Surface.	Buccal, labial and lingual.
Instrument.	Sickle-shaped.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin; or fist grasp—end of thumb on occlusal surface.
Motion.	Digital. Draw stroke.

Division 21.

Instrument.	Nos. 3 and 4 Harlan.
Use.	For small, hard, tenacious deposits under gingival border.
Motion.	Draw stroke.

SYSTEM FOR POLISHING—LARGE STICK.

Division 1. Fig. 68.

Teeth.	Upper right central and lateral.
Surface.	Labial.
Grasp.	Porte polisher held in fist.
Fulcrum-point.	End of thumb on cutting edge of right cuspid.
Motion.	Digital.

Division 2. Fig. 69.

Teeth.	Upper right cuspid, first and second bicuspids.
Surface.	Labial.
Grasp.	Fist.
Fulcrum-point.	Back of third finger on chin.
Motion.	Rigid-arm.

Division 3. Fig. 70.

Teeth.	Upper right molars.
Surface.	Buccal.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Rotary.

Division 4. Similar to Fig. 79.

Teeth.	Lower right molars.
Surface.	Buccal.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Rotary.

Division 5. Similar to Fig. 69.

Teeth.	Lower right bicuspids and cuspid.
Surface.	Buccal.
Grasp.	Fist.
Fulcrum-point.	Back of second finger on chin.
Motion.	Rigid-arm.

Division 6. Fig. 71.

Teeth.	Lower incisors.
Surface.	Labial.
Grasp.	Fist.
Fulcrum-point.	Thumb or first finger of left hand, depressing lips.
Motion.	Rigid-arm.

Division 7. Similar to Fig. 72.

Teeth.	Left lower cuspid and bicuspids.
Surface.	Labial.
Grasp.	Fist.
Fulcrum-point.	Back of second finger on chin.
Motion.	Rigid-arm.

Division 8. Similar to Fig. 72.

Teeth.	Lower left molars.
Surface.	Buccal.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Rigid-arm.

Division 9. Fig. 72.

Teeth.	Upper left molars.
Surface.	Buccal.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Rigid-arm.

Division 10. Similar to Fig. 69.

Teeth.	Left upper bicuspids and cuspid.
Surface.	Labial.
Grasp.	Fist.
Fulcrum-point.	Back of third finger on chin.
Motion.	Rigid-arm.

Division 11. Similar to Fig. 68.

Teeth.	Left upper lateral and central.
Surface.	Labial.
Grasp.	Fist.
Fulcrum-point.	End of thumb on cutting edge of right central.
Motion.	Digital.

Division 12. Fig. 73.

Teeth.	Right lower molars and bicuspids.
Surface.	Lingual.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Rotary (or using side of stick with rigid-arm motion)

Division 13. Fig. 74.

Teeth.	Right lower cuspid and incisors.
Surface.	Lingual.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger from cutting edge of incisors to first bicuspid.
Motion.	Rotary.

Division 14. Fig. 75.

Teeth.	Left lower cuspid, bicuspids and molars.
Surface.	Lingual.
Grasp.	Pen-holder.
Fulcrum-point.	End of second finger on labial surface of lower incisors.
Motion.	Both rigid-arm and rotary.

Division 15. Fig. 76.

Teeth.	Left upper molars and bicuspids.
Surface.	Lingual.
Grasp.	Pen-holder.
Fulcrum-point.	End of third finger on labial surface of right lower lateral or cuspid.
Motion.	Rigid-arm (or third finger on masticating surface of right upper bicuspid, rotary motion).

Division 16. Fig. 77.

Teeth.	Left upper cuspid and upper incisors.
Surface.	Lingual.
Grasp.	Pen-holder.
Fulcrum-point.	End of second or third finger on cutting edge of right upper cuspid.
Motion.	Rotary.

Division 17. Fig. 78.

Teeth.	Right upper cuspid, bicuspids and molars.
Surface.	Lingual.
Grasp.	Pen-holder.
Fulcrum-point.	Back of third or fourth finger on chin.
Motion.	Rotary.

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